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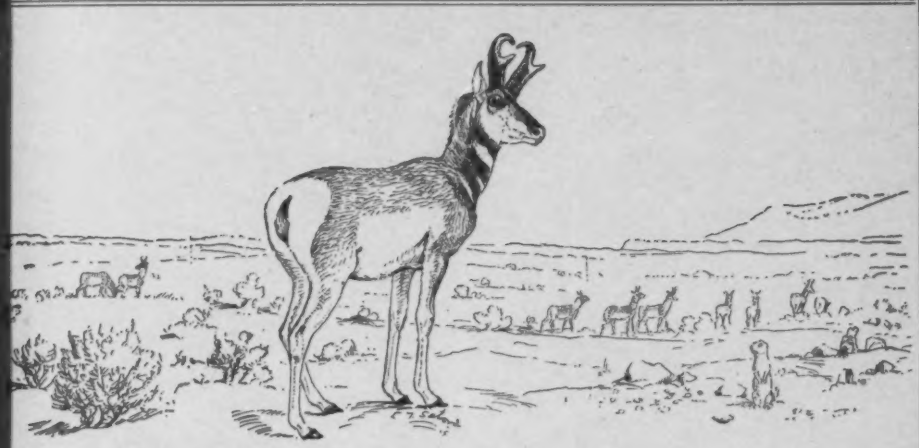

CONTENTS

		PAGE
Banding Bats	*A. A. Allen*	53
The Present Status of the European Bison or Wisent	*Theodor G. Ahrens*	58
Capturing Small Mammals for Study	*Vernon Bailey*	63
The Mammals of Itasca County, Minnesota	*Alvin R. Cahn*	68
Desert and Lava-dwelling Mice, and the Problem of Protective Coloration in Mammals	*Francis B. Sumner*	75
The "Hand-stand" Habit of the Spotted Skunk	*Charles Eugene Johnson*	87
On the Gorilla and Chimpanzee	*C. R. Aschemeier*	90
The Red Squirrel of the Sitkan District, Alaska	*H. S. Swarth*	92
Revised List of the Species in the Genus Dipodomys	*Joseph Grinnell*	94
Description of a new species of Phenacomys from Oregon	*A. Brazier Howell*	98
Notes on the Snowshoe Rabbit	*J. Dewey Soper*	101
General Notes		109

Opossum in Vermont, *G. L. Kirk;* Opossum Carries Leaves with its Tail, *L. L. Pray;* Notes on the European Hedgehog, *J. A. Loring;* Shrews and Weasels, *G. L. Kirk;* The Hog-nosed Skunk in Colorado, *E. R. Warren;* The Elephant Seal off Santa Cruz Island, California, *A. W. Anthony;* Mice and Chipmunks Help Restock Forests, *U. S. Dept. Agric.;* Recent Migration of the Gray Squirrel in Wisconsin, *H. H. T. Jackson;* Cæsarian Operation on Lepus alleni, and Notes on the Young, *C. T. Vorhies;* Dates of Shedding of Horns in Yellowstone Park, *M. P. Skinner;* Shed Horns of the American Antelope, *G. B. Grinnell;* Field Suggestions, *A. B. Howell.*

Recent Literature		118
The Northern California Section of the American Society of Mammalogists		123

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JOURNAL OF MAMMALOGY

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BANDING BATS

BY A. A. ALLEN, PH.D.

[*Plates 4–5*]

The interesting article by Mr. A. B. Howell on "Some California Experiences with Bat Roosts" in the August number (1920) of the Journal inspires me to put on record a few observations that I have made on the bats in central New York, and a recent attempt that I have been making to mark individual bats with the aluminum bands of the American Bird Banding Association.

Seven species of bats are known to occur at Ithaca, New York, five of which are common and widespread. The hoary bat, *Nycteris cinerea*, is known only as a migratory species from a few specimens taken during October, and the Say's bat, *Myotis subulatus*, has been found but twice, July 2, 1904, and June 11, 1914. Of the others, the large brown bat, *Eptesicus fuscus*, and the small brown bat, *Myotis lucifugus*, are abundant about buildings, the latter being the more common. The other three, *Nycteris borealis*, the red bat, *Lasionycteris noctivagans*, the silvery-haired bat, and *Pipistrellus subflavus*, the pipistrelle bat, usually roost about trees or in crannies in the rocky sides of the gorges. The pipistrelles, however, frequently assemble in dark corners of buildings along the edges of the ravines.

The only ones I have found roosting in colonies are the little brown and the pipistrelle, the former occurring during the breeding season in colonies often of several hundreds, in dark attics, cupolas, etc., while the latter usually roost in small clusters. The accompanying photograph shows a cluster of 18, the largest I have seen.

On June 24, 1916, a neighbor, Mrs. Willard Austen, living close to Fall Creek gorge, informed me that some bats had been roosting in a

dark corner of her porch for some time and were making a nuisance of themselves by soiling the floor. She wished me to do away with them. Upon examination I found four female pipistrelles hanging in the darkest corner of the ceiling of the porch, which was partially shut in, in their characteristic tight cluster. Mrs. Austen informed me that they had been there the previous summer and that efforts to dislodge them by turning the hose on them, and poking them with brooms, were only temporarily successful, as they always returned the next night. This interested me and I wished to determine whether it was always the same bats that came back in spite of the disturbance or whether this porch was a roosting place known to many bats. Accordingly I ascended to their retreat and picked them off without their making any effort to fly. It was at this time I discovered that they were females carrying large embryos and I surmised that they had come here to have their young. I then took four of the smallest size bands of the American Bird Banding Association and placed them on their legs, taking care not to close them completely, but pinching them on tightly enough so that they would not come off. I then carried the bats three blocks to my home where after observing them for a time, I released them.

Mrs. Austen promised to inform me if the bats returned but as I never heard from her, the incident was forgotten until three years later, June 29, 1919, when she telephoned me that the bats had again been annoying her. She had invited a small boy to shoot them and when they picked up the dead bats they found the aluminum bands on their legs. I secured the bats of which there were again four, and three of them bore the bands that I had put on three years before. The numbers were 15899, 15901, 15902. Number 15900 had either been lost from the leg or else the bat had disappeared and its place been taken by another. The fourth bat was a female and all again were carrying large embryos. I inquired of Mrs. Austen whether the bats had been roosting on the porch during the two preceding summers but as she had been away each summer she was unable to inform me.

This curious incident of the same three, and probably the same four bats, staying together or returning to each other after three years had elapsed, reminded me of how little we know of their habits. Again, Mr. Howell, in his suggestive account of the California bats, states his belief that most of our bats are migratory, but the very fact that we cannot state so definitely shows how little we know about them. He speaks, for instance, of the large brown bat, *Eptesicus fuscus fuscus*,

as absent or very rare during winter in California, but with us it is the only species for which we have definite winter records. On several occasions I have seen them flying about in the day time during February or March, and, nearly every winter in January or February, one comes out of hiding and flies about the halls of the Zoology building at Cornell University. All these facts point to the need for further study of these interesting little beasts. The valuable results that are now being obtained by banding birds could no doubt be duplicated with bats if only enough persons would coöperate in the project of banding.

Illustrating the ease with which the banding can be done when the opportunity offers, I discovered this year a cluster of pipistrelles clinging to the gable of my barn; holding an insect net beneath them, I touched one of them with a stick and instantly the whole eighteen dropped into the net. This was on June 5 and I observed that sixteen of the number were females heavy with young. (The pipistrelles, in this locality, normally bear two young.) Each of these bats was banded as described above and liberated. Most of them returned to the barn sooner or later as the size of the cluster seemed to be about the same a few days later. They cling so closely to one another that it is impossible to count them and, at this time, close observation of them was made impractical by their roosting beside a large hornets' nest. Between the first and the middle of July, apparently, the young were brought forth but it was impossible to tell exactly. On the night of the fifteenth, however, two of the young were large enough to be left alone, for when I scanned the gable with the aid of a flash light, I discovered them hanging where the whole cluster had been during the day. On the twenty-fifth of the month the pipistrelles had moved away from the hornets' nest and the young seemed to be of good size so I again held the net beneath the cluster. This time I did not hold it quite so carefully and two of the old bats escaped. Ten adults and sixteen young were captured, however, and of these nine of the adults bore the bands that had been placed upon them the fifth of June. The bands were somewhat scratched, probably by the bats' teeth, but the skin showed no signs of abrasion by the bands. All the young but one could fly, and they were much darker and grayer than their parents. Nine were females and seven were males. If each of the twelve females had had two young and there were but sixteen left, it bespeaks a rather high mortality, doubtless at the stage when they were learning to fly. The young were banded and all were released. After that time there

was a cluster of varying size in the barn up to the last of August but by September first they had dispersed or found another roosting place. It will be interesting to learn if they come back next year, if exactly the same ones keep together, and if the young return with them or, if their numbers are not augmented by the young, as was the case with the four banded in 1916. Whether the pipistrelle migrates or hibernates I am unable to say from my own observations. They appear in the spring about the first of May about the time that the migratory silvery-haired bats appear, and I have seen them as late as the first of November.

While on the subject of bats I should like to describe a breeding colony of the small brown bat, *Myotis lucifugus*, which I examined a number of years ago, July 5, 1907. It was in the attic of a house in Homer, New York, 22 miles from Ithaca. The house was of brick with a flat tin roof sloping toward one end, the attic ranging from 18 inches to four feet in height. At the lower end of the roof the tin had become loosened from the brick, causing a crack of from half an inch to an inch in width through which the bats gained entrance. The bats congregated at the lower end of the attic hanging head downward from the roof trusses in large mats. They did not, however, cling to one another or form such dense clusters as do the pipistrelles. These masses were composed chiefly of adult females and young nearly grown. In one place where the roof was scarcely 18 inches from the floor, a large cuboidal space had been formed in the brick wall owing to the rotting away of a large joist. Here large numbers of the oldest young had congregated with a few females carrying young. The place most populous with bats, however, and the place where probably all of the young were born, was the space above the brick wall and below the roof between the trusses. Here the pregnant females had gathered in large numbers. From one of these spaces, thirty females were removed, all with small young or large embryos. Of course there was no pretense of a nest, the young being brought forth on the bare bricks. These were moist with urine but the excrement was apparently all ejected onto the floor where it had accumulated in piles several inches deep.

No female containing more than one embryo was found although some of the females were accompanied by two young of very different sizes. In fact there seemed to be three distinct sizes of young in the attic of which from thirty-two to thirty-six of each size were secured. The smallest had apparently been born but a short time. Of these four-

FIG. 1. ONE OF THE FEMALE PIPISTRELLES, SHOWING ATTACHMENT OF THE BAND. JUNE 5, 1920

FIG. 2. A CLUSTER OF EIGHTEEN PIPISTRELLES HANGING TO THE GABLE OF THE BARN. JUNE 5, 1920

These bats were captured and banded

UNIV OF MICH.

FIG. 1. LARGE BROWN BAT (*Eptesicus fuscus*) WITH A BED BUG (*Cimex pilosellus*) BEHIND EACH EAR

A flashlight photograph taken immediately after the capture of the bat, before the bugs had moved.

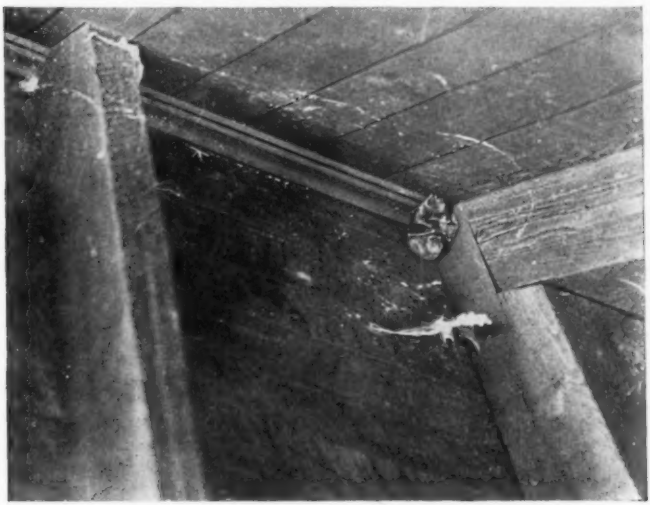

FIG. 2. A CLUSTER OF FOUR FEMALE PIPISTRELLES HANGING TO THE CEILING OF A PORCH

These bats were banded June 24, 1916, and three of them were found in the same place June 29, 1919.

UNIV. OF MICH.

teen were males and nineteen were females, averaging 52.5 mm. in length. They had very black skin, almost naked, what hair they had being pale brown. The second size, of which there were twenty-one males and fifteen females, averaged 60.8 mm. in length. They wore a thin covering of hair, more sparse on the venter, more buffy in color than that of the adults. The third size, of which there were thirteen males and nineteen females, averaged 72.8 mm. in length. They were fully haired, the color being much darker than that of the adults.

A few females were found accompanied by two young of the smallest and largest sizes and a few others that contained embryos were accompanied by medium-sized young which seemed to be nursing, indicating the possibility of more than one litter in a season. There is a bare possibility that in the confusion resulting from my disturbance some of the young might have become frightened and clung to the wrong mother. I am inclined to the belief, however, that this species never has but a single young at a birth and that it has two litters a season. The red bat, the silvery-haired bat, and the pipistrelle, on the other hand, normally bring forth two young and have but one litter.

I did not succeed in capturing all of the bats in this roost as there were many crevices from which I could not force them. In all, however, I secured 101 young and 135 adults. Of these 48 of the young were males but only four of the adults were males, indicating that while the sexes are normally of about equal number, they segregate during the season of gestation and care of the young. The presence of a few males may indicate that the males rejoin their mates for a short time between litters.

There is a popular superstition that bats carry bedbugs and during my stay in the attic I had plenty of opportunity to verify this belief as well as that they have innumerable fleas and mites. I made quite a collection from the bodies of the bats but unfortunately they were lost in transit and never identified. I have since, however, taken specimens from the large brown bat, *Eptesicus fuscus*, a photograph of which accompanies this article, which were identified for me by Mr. Van Duzee as *Cimex pilosellus* Horvarth, a species which never seems to infest man. I can supplement this statement by the fact that though I was in the attic for nearly two hours and saw them crawling all around, I received no bites, and careful examination of my clothes failed to reveal a single specimen.

Cornell University, Ithaca, N. Y.

THE PRESENT STATUS OF THE EUROPEAN BISON OR WISENT

By Theodor G. Ahrens

Originally there existed two types or species of wild oxen in Europe: The ur (urus), auerochs, Slavonic tur = *Bos primigenius;* and the wisent, Polish zubr, Roumanian zimbr = *Bos bonasus* L. or *Bison europaeus.*

The ur had no mane, resembled our domestic cattle, but had larger horns. The wisent has a mane, long hair on neck and shoulders, a hump, short horns and is a counterpart of our American bison. The ur became extinct in Europe, with the exception of Russia and Poland, in the fourteenth and fifteenth centuries.

Aristotle mentions the wisent in his history of animals with the title of "bonasos"; Pliny, Calpurnius Siculus, and Seneca describe it, referring to the Paeonian species. Pausanias and Dio Cassius (150–235 A.D.) speak of the wisents as "Paeonian bulls." Wisents and urs lived in Switzerland in the middle ages, but became extinct in France before 1400. The wisent is mentioned in Sweden in the eleventh century and wisent hunts are described in the Vilkina-saga, written in the thirteenth and fourteenth centuries. The wisent may have existed in England in the twelfth century, if certain references in the literature of the time may be believed, but the so-called "Wildwith cattle" in Chillingham Park and other herds of half-wild cattle in private estates are presumably descendants of the ur.

A classic mention of both species of wild cattle is to be found in the Nibelungenlied, the celebrated middle high German epic. Here the exploits of Siegfried, the principal hero of the poem, during a hunt in the Odenwald are described:

> Dar nach sluoc er sciere einen wisent und einen elch,
> Starker ure viere. . . . .

(After which he slew quickly a wisent and an elk, four powerful urs . . . .)

It should be mentioned that the words "auerochs" and "ur" have caused much confusion. These expressions were generally used for the wisent after the extinction of the ur in Germany. The word "wisent" was forgotten and did not come again into use until 1850, but has been generally used again since 1880. As "auerochs" was the official name for wisent—bison—zubr (Polish for wisent) from 1450 to 1850, we may be pretty sure that when "auerochs" is used in the literature of this

period, "wisent" is meant; but Baron Herberstein, who was German ambassador in Russia from 1516 to 1518, has correctly distinguished the two animals and illustrated them in his book "Moscoviter wunderbare Historien" (Wonderful Moscovite tales), calling the auerochs "auerox" and wisent "bisont."

The province of East Prussia, which belonged since 1511 to the Hohenzollerns, harbored a very considerable number of wisents. Many wisent hunts are mentioned in literature, and the animals enjoyed considerable protection. In 1726, 117 wisents were still counted, but in 1755 the last animal in East Prussia was killed by a poacher. In Brandenburg the wisent existed till the eighteenth century. It was carefully protected and in 1743 eleven were still accounted for. In 1768 the last Brandenburg wisent perished.

Wisents lived in Austria and Hungary throughout the middle ages, but became extinct there in the sixteenth century.

Finally the forest of Bieloviesh (Russian), Bialowies (German) or Bialowicza (Polish), in Lithuania near Grodno, and a district in the Caucasus Mountains are or were the only remaining regions in which any considerable numbers of indigenous wisents lived. To be sure, upon the estates of the Prince of Pless in southeastern Upper Silesia, and in Ascania Nova in southern Tauria (north of Crimea), belonging to the recently deceased F. von Falz-Fein, a small number were maintained, but these animals had been imported and were not indigenous.

The great forest of Bieloviesh had been a royal hunting preserve since the eleventh century and wisents could only be hunted there by special permission from the ruling dynasty. The Polish-Saxon kings protected the wisents and ceased to allow any economic use of the forest. After the dismemberment of Poland, the Russian czars continued this policy of protection so that up to our own times the forest remained a carefully protected sanctuary.

To give some idea of the hunts which took place in Bieloviesh under Polish rule, we learn that at one hunt, in 1744, 30 wisents were killed; 42 in 1752, and at the latter 1000 peasants were forced to act as beaters to drive the game together.

Since 1820 the czars prohibited the cutting down of trees and serious efforts were made to protect game in general, and wisents in particular. In 1860 the first imperial hunt took place. Two thousand peasants acted as beaters; many foreign princes and a great number of persons of all ranks were present. Twenty-eight wisents and much other game were killed. In 1897, 37 wisents were killed at an imperial hunt; in 1900, 45.

In 1828 Brincken remarks that: "à la fin de la dernière guerre le nombre des Bisons s' était diminué jusqu' à se réduire à 300."

Nevertheless in 1826 from 700 to 800 were counted; in 1829, 711; in 1830, 772; but in 1831, probably in consequence of revolutionary movements, 657 only. For the next fifty years this average must have been maintained; for in 1884–1885, 500, and in 1891, 479, were quoted. Thereupon a ukase of the 3/15 February, 1892, gave absolute protection to the wisents for all time, so that at the beginning of the present century more than 1200 are mentioned. In the following years severe epidemics broke out, so that only 727 remained in 1914. The war was naturally disastrous, so that when the German administration of the forest started, scarcely 160 remained. Since this event the wisents were counted every month as far as possible, and in March, 1917, the count showed 121, consisting of 18 old and 18 young bulls, 30 old and 36 young cows, and 19 calves. In 1918, after 30 square kilometers of the forest had been reserved as a natural sanctuary, the herd seems to have increased to 170 or 180 head.

The German efforts to protect the wisent began in March, 1915, when Professor Conwentz, head of the "Staatliche Stelle für Naturdenkmalpflege in Preussen" (Prussian Bureau for the Protection of Nature) called the attention of several army commanders in the East to the endangering of the wisent. The ninth army therefore caused a strict prohibition of wisent shooting to be issued, and on October 1, 1915, Captain (later Major) Escherich, a Bavarian Forstrat (forest commissioner), was appointed commander and head of the German forest administration of the occupied district.

Owing to the energetic efforts of this active and experienced forest official complete protection of the remainder of the wisent herd in this extensive forest, the inaccessible recesses of which rendered any control extremely difficult, was finally carried through.

As early as September 25, 1915, a ruling regarding hunting was issued by Lieutenant-General von Seckendorff, which declared: "We desire to preserve the Wisent herds as far as possible, although this is enemy territory, so as to convey to posterity a Natural Monument of peculiar value." Thus the best hopes for the future were entertained, but then came the collapse of the German power and the revolution of November, 1918. On December 16, 1918, shortly after the revolution, Major Escherich wrote to the "Staatliche Stelle": "In consequence of the events of the past weeks the military forest administration can no longer exercise any control over the protection of game in the forest

of Bialowies and consequently the Wisent herd of 170–180 head is seriously reduced. The imminent retreat of the German troops increases considerably the danger of extermination of the animals and thus extinction of the species is to be feared." In fact it seems that all or nearly all the remaining wisents have been shot by the inhabitants and the retiring German soldiers, among whom discipline had been undermined by the revolution. Notwithstanding, Professor Matschie of Berlin, who is well acquainted with the territory, told me that in his opinion it is very possible that wisents may still exist in impenetrable thickets of the forest. Unfortunately, there has been no corroboration of this view.

About the end of the seventeenth century the first news of wisents in the Caucasus reached Europe. Since then little was known of the species till Professor Filatow made three trips to the district between 1909 and 1911 for the express purpose of studying the animals. The Caucasian wisent varies but slightly from the type in Bieloviesh; the shape of the skull and the horns, which resemble those of the American bison, being the chief peculiarities. It is known as *Bos* (*Bison*) *bonasus caucasius* Grevé. At one time the Caucasian wisent lived in the district of Mount Elbrus, but its territory has been reduced to a comparatively small area in the Kuban region in northwestern Caucasia. Cutting down of the forests was the chief cause for the diminution. The last known area, where Caucasian wisents lived is as follows: Its northern limit is south of the towns of Atschcha and Atscheschbok, then along the bend of the Umschten and Schischa Rivers to the mouth of the Besymjanka, and somewhat south at the mouth of the Maltschepa. The whole area is 50 versts between east and west and 20 versts between north and south. According to Filatow, the number of animals was "scarcely less than 100, but under no conditions as many as 1000." Since the revolution the Kuban cossacks have demanded the return to them of these hunting grounds, which had been leased by them to the Grand Duke Sergius Michaelowitsch who endeavored to protect the wisents there, and thus an extermination of the species is also to be feared. Professor Matschie thinks that the remaining Caucasian wisents have abandoned their old range and emigrated to other regions, at present unknown.

The herd of Pless above mentioned was founded in 1864 or 1865, when a bull and three or four cows were presented to Prince Pless by Czar Alexander II. and the former placed them in his extensive estates in southwestern Upper Silesia. The animals increased there consid-

erably. In 1893, 5 more cows were introduced from Bieloviesh. In 1918 there were about 60 animals there, but according to Professor Pax of Breslau the animals in Pless have been severely decimated since the German revolution and total extermination is to be feared at the hands of poachers.

The present war between Poland and the Bolsheviki has again passed over the Bieloviesh region, continuous disturbances are taking place in the Caucasus, and Upper Silesia is in perpetual unrest because of the differences and antipathies between Poles and Germans. Besides the wisents still extant in Pless, and possibly in Ascania Nova, there remain a few specimens in zoological gardens. But, if we sum up, we must nevertheless conclude that the extinction of the species is imminent.

There exists a very extensive literature upon the wisent, of which a few works may be quoted:

1. Baron de Brincken: Mémoire descriptif sur la Forêt Impériale de Bialowicza en Lithuanie. Varsovie, 1828.
2. von Jarocki, Felix Paul: Zubr oder der lithauische Auerochse. Hamburg, 1830.
2. Eichwald, E.: Naturhistorische Skizzen von Lithauen, Volhynien und Podolien. Wilna, 1830.
4. Büchner, Eugen: Das allmähliche Aussterben des Wisents im Forste von Bjelowjeska. St. Petersburg, 1895.
5. Bialowies in deutscher Verwaltung. Herausgegeben von der Militärforstverwaltung Bialowies. 1 und 2 Heft, 1917. 3 und 4 Heft, 1918. 5 Heft, 1919. Berlin.

Besides countless articles and essays in hunting periodicals, in the literature appertaining to the protection of nature, etc.

Landauerstrasse 4, Berlin Wilmersdorf, Germany.

CAPTURING SMALL MAMMALS FOR STUDY

By Vernon Bailey

As we look backward the field study of mammals seems a comparatively recent development in North American mammalogy. Briefly, the published works of Richardson in 1829, Audubon and Bachman in 1845, Baird in 1857, Coues and Allen in 1877, and Merriam in 1884 mark the development of mammal study in this country. Among these Baird was the pioneer in the formation of a North American collection of mammals, but the fact that satisfactory methods of collecting and preserving small mammals had not been devised, prevented the accumulation of series of specimens meeting the demands of modern methods of study. It remained for Doctor Merriam and his associates to develop the science along these lines, and under his guidance the large series of specimens which laid the foundation of our present knowledge of the mammals of North America were brought together. The methods of collecting were gradually standardized and improved until today we have many museums stocked with well-prepared and carefully labeled specimens. Intensive collecting should be continued until the gaps in our museum series are filled, and every college, normal school and high school has its collection of local species.

The series of mammal specimens in the Biological Survey collection have now reached such proportions that along certain lines of collecting we are slowing up. The present policy of the survey is to collect fewer and only choice specimens except in special cases or in unworked areas. This affords what many of us have long felt the need of, more time for a closer study of life-histories.

The recent outlines for field study of life-histories by Seton, Nelson, Taylor, and Anderson are steps in the right direction. These are mere outlines, however, and while rich in suggestions they need to be amplified for the benefit of beginners.

The first question that arises is where and how to find something to collect or study. Take the abundant and easy things first. One can find plenty of meadow mice and white-footed mice almost anywhere outside of city limits. Go into the meadows, old fields, or grassy fence rows, get down on your knees, part the grass, and you will probably find little trails or runways over the surface of the ground. Their appearance, bits of cut grass stems, and other signs of occupation generally tell you if the mice are there. Or go into the woods or to a rocky slope and look under logs, in hollow trees, under stones, in little

caves and niches of the cliffs and ledges for tracks or traces of white-footed or red-backed mice, or for tiny burrows and runways of shrews, or for larger burrows and hollows where chipmunks live. Or go into the woods and find the homes of flying squirrels by pounding on the sides of hollow trees or trees with old woodpecker holes in them, and watch the flying squirrels peep out and in response to harder pounding soar away to other trees. Listen for the chatter of red or pine squirrels and then steal up quietly and watch them at work or play and get their home range located so that you can come and watch them at any time. Learn how to find the common species and you will gradually learn to find the rare ones.

The next step is to get the animals you want for specimens or to catch them alive for closer study. If you wish specimens, set any of the half dozen kinds of snap traps that come down across the necks or backs and kill quickly, selecting the right sizes for the animals you are trapping. In runways set the trap across the run so the trigger will be in the way of passing mice, and sprinkle rolled oats over it. For white-footed mice and others that do not make runways place the traps where they feed or travel and sprinkle plenty of rolled oats over the trigger and a little around the trap. For chipmunks and flying squirrels use larger traps, generally the size made for rats, set on logs or stumps or in hollow trees or little shelves on the sides of trees, and baited with nuts or bread fastened to the trigger and sprinkled over with rolled oats. For shrews set mouse-size traps under logs or rocks or banks or at little burrows in woods earth, with a bit of fresh meat or bacon on the trigger and also a sprinkle of rolled oats. A great variety of baits may be used, grains, seeds, nuts, bread, meat, and vegetables according to the tastes of the animals, but rolled oats seem to appeal to the greatest number. There are several pamphlets giving directions for preparing specimens.

While catching animals for specimens is a very necessary and fundamental part of our study, the process does not teach us much of their habits. Catching them alive for study is just as easy. Forty years ago I had to make all of my traps for small mammals and most of the traps caught the animals alive and uninjured.

The simplest trap is the inverted bowl. A glass bowl is good but a tin can, pan, bucket, or box will do. A light dish or box may need a stone on top for weight. Cut out of a thin board or shingle a trigger, rounded at one end and pointed at the other. Fasten some bait to the pointed end and place the rounded end under the edge of the bowl or

box and the baited end about the middle underneath. The mouse wiggles the bait and the bowl drops over him. You slide a paper, tin or bag under the bowl and pick up your mouse and place him in a bag

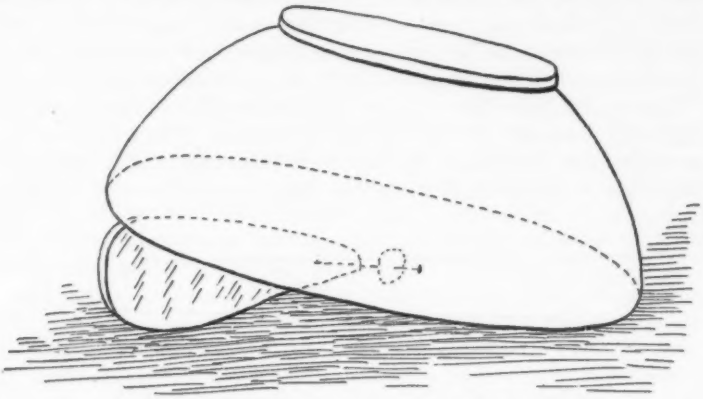

FIG. 1. BOWL TRAP FOR CATCHING MICE ALIVE

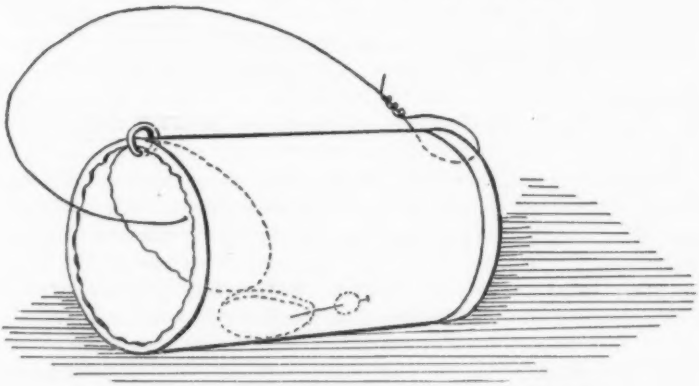

FIG. 2. TIN CAN TRAP FOR CAPTURING MICE ALIVE

or box or cage. Some food and nest material may be placed inside the trap if the weather is cold or you cannot come back soon to examine the trap.

A tin can makes a good live trap. Cut a piece of tin to fit inside of the open end. Hinge it with a wire loop at one edge so it swings in

and not out. Fasten a springy wire along the outside and attach to the lid so that it is drawn shut. Push the lid in and place a baited spindle under its lower edge to hold it open until the mouse wiggles the bait. Then the spindle drops and the door snaps shut with the mouse inside. A still simpler trap may be made by cutting a hole in one end of a tin box and placing a sloping hinged door inside that easily lifts up for the mouse to enter and drops down behind him.

The regular figure-four trap or one of the various forms of rabbit traps may be made of tin or boards for animals of larger size up to woodchucks and raccoons. In fact much of our fur could be taken in such traps with less cruelty and less injury to the fur than in steel traps.

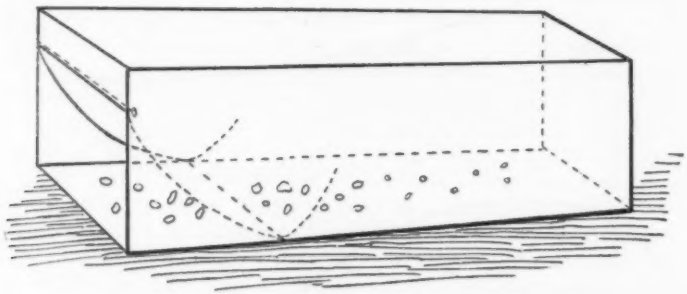

FIG. 3. TIN BOX TRAP FOR CAPTURING MICE ALIVE

Deep holes in the ground near the burrows or runways of some species of mice and shrews will catch the animals, but other kinds will not fall into them. Many mice may be caught in your hands if you know where to find them under the haycocks and grain shocks when the grain and hay are being hauled. With a little practice you can catch any mice that are uncovered in the field and hold them so they will not bite you. By following the tracks of white-footed mice on the snow to their underground winter dens you can easily dig down and catch them in your hands. I have caught as many as four at a nest in this way. With a light pick and shovel you can dig out many burrowing species and in doing so learn much of their habits, homes, nests, young and food, besides catching the animals alive for study.

The next thing is how and where to keep your menagerie. Simple wire screen cages with wooden or tin bottoms and ends and sliding

doors are easily made and prove the most satisfactory of any I have tried. These can be kept on a table in your library where you can watch the animals, play with them in your spare moments, and learn much of their habits in captivity that you will never learn in the field. It is a fascinating study. I have had a pocket gopher, a meadow mouse, six white-footed mice of three species, and four pocket mice on a table in my library all winter and am finding out new habits every few days—new at least to me.

The little pocket mice are especially gentle and easily handled. With their silky coats and quiet ways they are the favorites with the children who love to hold and play with them. The white-footed mice are still too nervous and sensitive to be handled much and it may take a second generation to make them sufficiently domestic for good pets. They are the most beautiful, graceful, and animated of the lot.

The meadow mouse has more individuality than I ever credited it with. A female in my collection is not afraid, but objects to being handled or petted, and will bite if caught and held. She will sit in my hand and run over my arms and clothes, but prefers her independence. She is quick and skillful but cautious. For over six weeks her cage door stood open and she ran over the table and among the cages as she pleased but never fell or jumped off. Then the cages were moved so she got onto the window sill and down to the floor and she soon learned to get down, even if she had to jump.

The pocket gopher has undergone the most surprising reformation. Instead of trying to eat me up as he did at first he often begs me to take him up out of his box of earth and will climb into my hand and scratch my arm and pull at my sleeve, and is happiest when I hold him and stroke his glossy coat. He is too full of energy to be quiet for long, and soon wants to get down to run round and round the room or out in the yard where he can burrow in the ground, or in his barrel of earth where he digs furiously by the hour. We have to be careful not to touch him until he knows who is there, for he does not see well and when surprised his first impulse is to bite whatever comes within reach. But even the children have learned to play with him safely and have great fun watching him dig in the ground and push out loads of earth, and fill his capacious cheek pouches with food.

All of these animals were caught when practically full grown and it has taken a long time to get them gentle. Still there are advantages in studying their habits which had become fixed and natural in the wild state. There will be other advantages in studying young raised in captivity as they will be free from any restraint or nervous tension.

All of the mice are interested in little "ferris wheels" in which they spin and ride by the hour, getting their exercise and much evident enjoyment from them. Even the little pocket mice, usually so quiet, become enthusiastic, spinning their wheel.

We have learned much that is new to us of their habits, dispositions, tastes, voices, calls, signals, hours of work and play, sleep, nest-building, sanitation and general home-making. Their time and manner of molt have been carefully noted. Their breeding habits are still to be studied. The only trouble is for busy people to get time enough to watch them, but there are many who need just such occupation and would greatly enjoy it. I hope to see a large number of people started in this kind of study, the results of which will be far-reaching in practical knowledge of our numerous species of small mammals.

Biological Survey, Washington, D. C.

THE MAMMALS OF ITASCA COUNTY, MINNESOTA

By Alvin R. Cahn

Itasca County, one of the largest of the Minnesota counties, lies in the north central part of the state, Koochiching County intervening between it and the Canadian boundary. Sparsely settled, with few cities of any size, the county retains a considerable variety of primitive qualities, though lumbering years ago and frequent forest fires have done much to ruin an otherwise ideal environment. A myriad of lakes, countless small streams and sphagnum bogs, hemmed in and surrounded by pine woods, however, still shelter and protect an abundance of animal life.

Yet this county, like so many of the unsettled regions of the north, is doomed in the not far distant future to undergo great changes. Further lumbering, clearing of land, homesteading, and road building will open up what is now almost inaccessible territory, and these developments will of course exert great influence upon the wild life of the region. The transition from the primitive conditions of the woods to their present state has led to the total extinction of several mammals, and to the reduction of others almost to the point of extermination. Further change will stamp out these latter and greatly reduce other species.

It seemed advisable, when the opportunity presented itself, to investigate the vertebrate fauna of this region before further changes occurred. This chance came to the writer during the last half of July and in August, 1919. During this period much of the county was covered, and the results of that portion of the investigation relating to mammals are herewith presented. A report on the avifauna of the county has been published elsewhere.[1]

The data upon which this paper is based are from two sources: personal investigation, and information furnished the writer by Mr. George Dwigans, a woodsman who has spent years within the county, and who is perfectly familiar with its big game. The investigation was made possible through the kindnesses of Dr. Sydney Kuh, who has a cabin in the heart of the county, and to him the writer expresses his appreciation.

A list of the mammals of Itasca County follows.

1. Northern Virginia Deer. *Odocoileus americanus borealis* Miller.—Still reasonably common throughout the county. The great areas available for its habitation—including a considerable amount of forest and game preserve—together with the scanty settlement of large sections of the county are conducive to the welfare of the species. In spite of the fact that the deer are relatively undisturbed during most of the year, they are shy and suspicious as compared with those found in northern Michigan and Wisconsin. However, during the early summer, deer visited the vegetable garden near the cabin almost nightly, as disclosed next morning by the tracks in the soft earth. On the morning of August 1, Doctor Kuh and Mr. Jacobsen surprised a doe and two fawns on the road near Lawrence Lake (Prairie River) and their automobile came within a few inches of running one down.

2. Moose. *Alces americanus* Jardine.—Rapidly nearing extinction in Itasca County, and very seldom seen. The species is probably more of a migrant from the country to the north and west than a permanent resident within the county. During the early summer—June, 1919—the tracks of a large sized moose were found one morning traversing Doctor Kuh's garden on Lake Minnewanka, an incident which has occurred several times during previous years. Doctor Kuh has the mounted head of a bull which was killed during the hunting season in 1911. If the moose is to be saved anywhere outside of forest and game preserves, it is high time that it be protected to the full power of the law. The moose is about to be added to the list of animals that *formerly* inhabited the county, to which list already belong the caribou, elk, fisher and marten.

3. Canada Lynx. *Lynx canadensis canadensis* Kerr.—Because of its secretive habits, the lynx is very seldom seen. It occurs, however, throughout the county, and is quite often taken by trappers during the winter months. During August,

[1] Cahn, A. R., Bird Notes from Itasca County, Minnesota. Wilson Bull., vol. 32, no. 4, pp. 103–122. December, 1920.

1917, Mr. Dwigans and party "spotted" a fine specimen on Lake Elizabeth. Confused by the light, the lynx permitted the canoe to approach within ten feet. The animal was on the ground, and had evidently come to the lake to drink.

4. Wild Cat. *Lynx rufus rufus* (Güldenstædt).—The writer has, unfortunately, little information to offer regarding this species. It occurs sporadically throughout the county, but in no considerable numbers.

5. Domestic Cat. *Felis catus* Linn.—Included in this list because there are a great many "house" cats that have taken to the woods, where they spend all their time. These animals are self-sufficient; they are essentially wild, as they can not be approached, and are dependent entirely upon their own wits and skill for their subsistence.

6. Timber Wolf. *Canis nubilus* Say.—Still fairly common within the county, but greatly reduced in numbers over former years. Although it is heard occasionally, the timber wolf is rarely seen during the summer. During the winter, however, so Mr. Dwigans tells me, it is frequently seen in clearings and crossing the frozen lakes. As the species travels considerably in winter, it is altogether likely that there is an influx of wolves during the cold weather.

7. Brush Wolf. *Canis latrans* Say.—This smaller wolf—never, by the way, called "coyote" in the north woods— is considerably more common than its larger relative, and is distributed throughout the county. Seldom seen in the summer, but heard by the writer during the night on many occasions.

8. Red Fox. *Vulpes fulva* (Desmarest).—The red fox, once rather common in Itasca County, must now be considered rare. The writer found no evidence of its presence, but during the last few years Mr. Dwigans has taken several very fine specimens within the territory under discussion. Of the color phases of the red fox, two have been taken: the cross fox, and the silver fox. As these phases are considered by the natives to be distinct species, a word regarding them may not be out of place. The silver or black form is the dark phase of the red fox; the cross fox is intermediate between the red and the silver. Both are, then, merely individual color phases of the red fox. "In a litter of fox cubs born of red parents, perhaps there may be a silver. On the other hand, one or more of the cubs of a silver vixen are quite certain to be red."[2] Under domestication this tendency of silvers to throw red cubs can be overcome by selective and careful breeding.

9. Northern Black Bear. *Ursus americanus americanus* Pallas.—Very nearly extinct in Itasca County. Those individuals that remain are so wary that they are very seldom seen. However, tracks and signs are met with occasionally, and no doubt the forest preserves and the more inaccessible places still hold their occasional bear. Although the black bear is by all odds the most common, the cinnamon phase is not unknown. Doctor Kuh has a very beautiful pelt of a brown bear taken near his cabin a few years ago. The black bear is another of the mammals that will not long survive within the county unless rigidly protected.

10. Racoon. *Procyon lotor lotor* (Linn.).—Somewhat more common in Itasca County than the following species, but still a rare animal in the county, being

[2] Dearborn, Ned, The Domesticated Silver Fox. Farmers Bull. no. 795, U. S. Dept. of Agr., p. 4, March, 1917.

seen and taken only occasionally. Doctor Kuh has the skins of several racoons taken in the vicinity of Lake Minnewanka, and all are typical in size, color and markings.

11. Badger. *Taxidea taxus taxus* (Schreber).—The badger must now be considered very rare in Itasca County, and is rapidly approaching extinction in this area. Once not uncommon, it is now almost unknown. At Ely the writer found a skin of this animal that was taken within Itasca County during October of 1918, but the exact locality—other than that it came from the northwestern section—could not be ascertained. Mr. Dwigans has taken the animal several times in the county.

12. Canadian Otter. *Lutra canadensis canadensis* (Schreber).—Common throughout the county, and steadily and rapidly increasing in numbers. Along the shores of Beaver Lake "otter runs" were in evidence. Several individuals were seen in Lake Minnewanka during the writer's stay, and on the shore of Rice Lake five old signs were found, all being 100 per cent crayfish remains. With the otter as common as it is in Itasca County, it would not be amiss to open the trapping season for two years. If opened, however, the situation should be carefully watched by the game warden department and by competent observers, and closed again at the end of that period if conditions warrant.

13. Mink. *Mustela vison letifera* Hollister.—Common throughout the county, frequenting the lakes and rivers, where it feeds largely upon crayfish, frogs and some of the smaller shore fishes. Successfully trapped during the open season; the fur is of high grade both in quality and in color.

14. Least Weasel. *Mustela rixosa rixosa* (Bangs).—This little weasel (length about 6½ inches), easily recgonized by the absence of the black tip on the tail, is relatively common in spots, and is apparently local in distribution. Two individuals were seen on August 14 near Cedar Lake.

15. Short-tailed Weasel. *Mustela cicognanii cicognanii* Bonaparte.—Considsiderably larger than the preceding (length about 12 inches), this weasel is told at a glance by the always present black tip of the tail. Several skins were seen at Ely, and one live individual was seen on July 30 at Lake Minnewanka. It seems possible that the long-tailed weasel (*Mustela longicauda spadix* Bangs) may occur occasionally, though this area probably is about the northern limit of the species. The writer was told that occasionally a much larger weasel, with a black tipped tail, is taken, which may well be this larger species.

16. Skunk. *Mephitis hudsonica* (Richardson).—Abundant throughout the county, and often in evidence. During the summer of 1919, one of these animals insisted on living under the cabin floor, much to the joy of Bubbles, the family "badger dog," who persisted in his endeavors to dig it out. These performances were unsuccessful in many ways, and were unpleasant particularly because Bubbles usually became interested about meal time. Every evening after dark the skunk wandered down to the garbage dump, and we could hear him rattling around for several hours. It is interesting to note that the dominant form is the "full stripe," and Mr. Dwigans assures me that he has not had any "black" specimens among the many skunks which he has taken.

17. Minnesota Varying Hare. *Lepus americanus phæonotus* Allen.—The only rabbit of which the writer could get any trace was the big "white rabbit" or "snow-shoe." This interesting form is common, and was seen frequently during

rambles through the woods, and along the roadside when traveling by machine at night. Some species of cotton-tail is present, but no specimen was procurable for identification.

18. Red-Squirrel. *Sciurus hudsonicus hudsonicus* (Erxleben). — Common everywhere in the woods and about the towns. The oak trees furnish the chief item of food for the species, though the hazelnut (*Corylus* sp.) is common enough to be of some use. Young were seen playing about the nest on July 21.

19. Lake Superior Chipmunk. *Eutamias quadrivittatus neglectus* (Allen).— Two species of chipmunks are found within the county, of which this is the more common. Found everywhere through the wooded areas where it feeds upon any available nuts. Unlike the next species, this little fellow shows a marked inclination to climb.

20. Gray Chipmunk. *Tamias striatus griseus* Mearns.—Quite common throughout the county, both in the hardwood and evergreen thickets. Found co-existent with the preceding species, and both seem to show a preference for the hardwoods. This species shows a decided preference for the ground, and is seldom found "up a stump." Food consists of berries and nuts. Called the "gray" chipmunk because of the gray tinge of the upper parts.

21. Gopher. *Citellus tridecemlineatus* (Mitchill).—Rare in the cleared lands, but found occasionally in the cultivated areas about the towns and farms. This county probably represents about the northern and eastern limit of the species in the state.

22. Woodchuck. *Marmota monax canadensis* (Erxleben).—Quite common throughout the county and often seen, either in the clearings or along the roads. A woodchuck took up his residence under the cabin floor, but departed hurriedly when the family—and Bubbles—arrived. This hole was quickly—and permanently—occupied by the afore-mentioned skunk.

23. Flying Squirrel. *Glaucomys sabrinus sabrinus* (Shaw). The flying squirrels are always very little in evidence, and unless special search is made their presence would never be suspected. This species is relatively common throughout the county, both in the woods and about the homesteads and towns.

24. Porcupine. *Erethizon dorsatum dorsatum* (Linn.).—Common throughout the county in all suitable places, yet not nearly as common as the writer found the species either in northern Wisconsin or in northern Michigan. This is, of course, not to be regretted, for the animal does a large amount of damage. Prefers the hardwood thickets, and feeds largely on the top-most branches of the ash (*Fraxinus americanus*) and the aspen (*Populus tremuloides*). Along the lake shores it feeds upon the succulent stems and roots of the arrow-heads (*Sagittaria* sps.) and the white water lily (*Castalia odorata*).

25. Beaver. *Castor canadensis michiganensis* Bailey.—Very nearly exterminated within the county limits. The writer saw but a single colony, apparently healthy and in a thriving condition, on Beaver Lake. The house here was of good size, and of the shore-line type, with the entrance in about eighteen inches of water. Evidence of activity was found in well worn log-shoots, and in a small ash (*Fraxinus americanus*) cut the night before. Until a year ago (the fall of 1918) there was a colony of two small houses in Rat Creek, between Little and Big Rat Lakes. Here a dam had been built, which seriously damaged fourteen tons of good hay belonging to a homesteader. Now the beaver—and

a part of the dam—are gone: the conclusions are obvious. There is another colony, which the writer did not visit, on McCabe Lake, just north of Beaver Lake, and so far as the data go, these are the only two colonies in the county.

26. Muskrat. *Ondatra zibethica zibethica* (Linn.).—Common throughout the county wherever there are suitable conditions, but surprisingly little in evidence as compared with northern Wisconsin and northern Michigan. Seen swimming in Lake Minnewanka, in Cedar, and Rice Lakes, as well as in many of the small unnamed lakes, and heard splashing almost every night. Several houses were seen, though none was of considerable size.

27. Meadow Mouse. *Microtus pennsylvanicus* (Ord).—Abundant throughout the county, and seen usually as a dark moving object in the leafy underbrush. The species is more active at night than in the day time. An individual of the species was seen crawling about on a pile of drifting wood in the locks where the Mississippi River leaves Lake Winnibigoshish. Evidence of damage to young fruit trees was common in new orchards.

28. Norway Rat. *Rattus norvegicus* (Erxleben).—Found commonly about the homesteads and in the towns, and probably quite local in distribution. However, it mysteriously appears upon the scene shortly after a house is built, probably being transported with the lumber or boxes.

29. House Mouse. *Mus musculus* Linn.—Common about the homesteads and in the towns.

30. Northern Deer Mouse. *Peromyscus maniculatus gracilis* (LeConte).—This beautiful rodent is very common throughout the county, and is frequently seen both in the woods and about the houses, in which it makes itself perfectly at home. Gets into the food supply, but does no serious damage.

31. Jumping Mouse. *Zapus hudsonius* (Zimm.).—The writer is unable to offer any information as to the abundance of this species in the county, but its occurrence is undoubted. A skin found at Ely was taken within the county in July, 1917, and the presence of the species is known generally to those familiar with the smaller animals of the region.

32. Short-tailed Shrew. *Blarina brevicauda brevicauda* (Say).—Seen by the writer only once; little information can be offered at the present time as to the abundance of the species.

33. Common Shrew. *Sorex personatus personatus* St. Hilaire.—A single specimen of this little shrew was found in the woods under a pile of cut logs, near Lake Minnewanka, on August 12. The animal measured 84 mm., and the stomach contents were entirely cricket remains.

34. Richardson's Shrew. *Sorex richardsoni* Bach.—Two shrews of this species were found, one dead near the cabin, and another brought in by Bubbles. They measured 110.5 mm. and 114 mm. respectively.

35. Marsh Shrew. *Neosorex palustris* (Rich.).—This, the largest of the shrews found, is recorded from a single specimen caught in a swamp near Cedar Lake, and from another seen at Balsam Lake. The former measured 151.5 mm.

36. Say's Bat. *Myotis subulatus subulatus* (Say).—This bat is very common everywhere in the county, and is found both in the woods and around the homesteads.

37. Little Brown Bat. *Myotis lucifugus lucifugus* (LeConte).—One of these bats was taken and two more seen, all near camp on Lake Minnewanka. The

two were seen almost every evening, beginning their twilight excursions about seven o'clock.

38. Red Bat. *Nycteris borealis borealis* (Müller).—Several were seen on August 8, between Bovey and camp. The stomach of one examined contained unidentifiable insect remains, mostly Diptera.

EXTERMINATED MAMMALS

The following species of mammals are known to have existed in Itasca County within the last fifteen or twenty years, but the writer is unable to offer any data whatsoever that would indicate that they are at present to be found therein.

1. Woodland Caribou. *Rangifer caribou sylvestris* (Rich.).—Formerly present, though it is doubtful if the type of country is such as to have attracted the species in any great numbers. Reported by Herrick[3] from the St. Louis River (which is in St. Louis County) a few miles east of Itasca County.

2. American Elk. *Cervus canadensis canadensis* Erxleben.—Never really common in Itasca County, owing to the fact that it is a forested country. Reported by Herrick[4] as common from Lake Itasca (in Clearwater County, about 35 miles west of Itasca County) in 1885. There are no records of either species within the last fifteen years.

3. Marten. *Martes americana americana* (Turton).—Disappeared, apparently, soon after the caribou and elk. It is possible that an occasional marten may still be caught as a wanderer from another part of the coniferous area.

4. Fisher. *Martes pennanti pennanti* (Erxleben).—The most recent of the exterminated mammals, and there is a bare possibility that it may still exist, though the writer can find no recent records of its presence. Like the marten, probably a wanderer from adjacent territory.

Texas Agricultural & Mechanical College, College Station, Texas.

[3] Herrick, C. L., Mammals of Minnesota. Geol. & Nat. Hist. Surv. of Minn., Bull. 7, 1892, p. 277.

[4] Herrick, C. L., ibid., p. 280.

DESERT AND LAVA-DWELLING MICE, AND THE PROBLEM OF PROTECTIVE COLORATION IN MAMMALS

By Francis B. Sumner

[*Plate 6*]

The prevailing tendency of desert animals—particularly the mammals, birds and reptiles—to assume a buff or pallid hue is a phenomenon which has long attracted the attention of naturalists. In many cases these colors harmonize strikingly with those of the bare sand and gravel, as well as with the commonly parched and stunted vegetation amid which such animals dwell. Oftentimes the creature need only come to rest in order to disappear from view, its presence becoming evident only when running or flying is resumed.

At a first glance it would seem perfectly evident that we here have to do with the well-known phenomenon of concealing coloration. This, we might suppose, has been acquired by these various creatures through the process of natural selection. The vegetable feeders among them have become more and more invisible to their carnivorous pursuers, while the latter have profited in being concealed from their prey. It is commonly assumed by those who hold this view that the color variations which are selected for survival are quite random in their origin, at least to the extent that they are not influenced in any direct way by the environment.

Various facts make it evident that this explanation is quite inadequate in the case at hand. I will mention but a few of the more obvious objections here. Later, I shall discuss certain special lines of evidence, based upon my own field and laboratory observations.

(1) Most desert rodents are strictly nocturnal in their habits. (This, admittedly, is not a conclusive argument, since the moonlight of the desert is brilliantly clear, and it is probable that owls, at least, among the predators, are largely guided in their search for prey by sight.)

(2) One group of these rodents—the pocket gophers—spend practically their whole time beneath the ground. Nevertheless, strikingly pale species are to be found in certain desert regions. (Here again, it must be admitted that carnivorous animals, both birds and mammals, lay a heavy toll upon the gophers, catching them frequently when they are half emerged from their holes.)

(3) The process of depigmentation applies to parts of the body which are not exposed to view. For example, the soles of the feet of

desert deer-mice are nearly or quite lacking in pigment, while those of mice from the more humid coastal regions vary from purplish to nearly black. Again, the fur of the ventral surface of the body is whiter, in desert forms, owing to the relatively greater length of the terminal unpigmented zone of the individual hairs. Akin to this is the fact that the ventral white area of the pelage tends to extend higher upon the sides of the body, a circumstance which would seem to render the animal more, rather than less conspicuous.

(4) The dorsal white stripes of the skunk are broader in the desert races.[1] It has rarely been contended that the skunk owes its peculiar fur pattern to the need for concealment. The class of facts cited in the last two paragraphs seems to indicate that depigmentation, rather than concealing coloration *per se*, is the thing which results from life in arid regions.

(5) I shall offer evidence below which tends to show that the need for concealing coloration on the part of these rodents has been greatly overestimated.

The general correlation between depth of pigmentation and atmospheric humidity is, of course, a widely recognized fact. Not only may we contrast the pale desert races with their dark relatives from the humid coast belt of the northwest, but various intermediate stations may be chosen, whose birds and mammals display intermediate shades in their feathers and fur.[1a] This principle is not, of course, one of universal application, the correlation in respect to color-tone being very imperfect. Nevertheless, the phenomenon is so widespread and so well known that I need not even cite specific cases in the present discussion.

Now the hypothesis of concealing coloration through natural selection might doubtless be advanced with a certain degree of plausibility to cover this entire situation. It could be pointed out that regions with more humid climates (at least those having a higher rainfall) have darker (appearing) soils than the less humid ones, and that therefore the effective correlation may be between pigmentation and soil color, rather than between pigmentation and humidity *per se*. But the fact that outside of the desert regions the ground, in a state of nature, is commonly covered by vegetation renders such an argument very unconvincing. Green grass is doubtless somewhat darker than dry

[1] See Grinnell (Univ. of California Pub. Zool., vol. 12, p. 257).

[1a] Instances of this tendency among mice are discussed in papers by the present writer, in the American Naturalist (April–May, 1918,) and the Journal of Experimental Zoölogy (April 5, 1920).

grass, but a seal brown mouse would probably be no better concealed in the former than in the latter.

We come now to cases in which narrowly localized races have been described, that are said to harmonize more or less strikingly with some special habitat, in respect to color-tone, and to differ noticeably from their near kin in regions closely adjacent. In some of these cases, at least, the argument that the responsible agent has been optical, rather than atmospheric, assumes a higher degree of plausibility.

Several writers have recorded the existence of very pale races of wild mice upon isolated beaches or sandy islands along the coast.[2] In a previous paper,[3] I have analyzed one of these cases rather carefully. I there dealt with a paler sub-race of *Peromyscus maniculatus rubidus*, inhabiting a practically isolated sandy peninsula on the northern California coast. Through the use of an accurate method of color determination,[4] I am now able to indicate the relative shades of the skins from the peninsula and from the redwood forests of the mainland across Humboldt Bay. The proportion of black in the two cases is 89.0 per cent for the former and 90.9 for the latter. These figures are based upon 21 and 29 mature skins respectively. The difference (1.9 per cent) is not great, but it is about 12 times its probable error (± 0.16) and therefore cannot be accidental. Furthermore, it is to be remarked that all but one of the peninsula mice show less than 90 per cent of black; while all but three of the redwood mice show more than 90 per cent. Indeed, the difference between the two series is quite evident to the eye, even upon casual inspection.[5]

[2] For instance, Bangs (see Osgood, North American Fauna, No. 28, 1909, p. 121) described such a race from the island of Monomoy on the Massachusetts coast. See, also, interesting recent accounts by G. M. Allen and by A. H. Howell (Journ. Mamm., November, 1920).

[3] American Naturalist, March, 1917; Osgood (Revision of the Genus Peromyscus, p. 66) had already referred to the case in question.

[4] Flat skins, prepared according to a uniform method, and cleaned in benzine, are subjected to color analysis by means of the Hess-Ives Tint Photometer. In the present paper, the figures given represent the average tone of an area of the pelage, 24 mm. wide by 17 long (the dimensions of the visible field) and lying symmetrically, near the posterior end of the dorsal surface. One great advantage of the instrument used is that the area under analysis is rendered perfectly homogeneous and is thus strictly comparable with another homogeneous field which serves as the standard. Later I hope to discuss the use of this instrument in the study of mammalian pelages.

[5] If we consider the percentages of white, rather than of black, we have 9.2 and 8.0 respectively for the two series. This makes the difference 15 per cent of the lesser number. A much smaller increase in the proportion of white upon a color-wheel is very evident to the eye.

I have already reported[6] that these differences appear to be hereditary. Unfortunately, only three specimens of the peninsula stock have been reared at La Jolla, but all of these are paler than the palest of the redwood stock, reared at the same time, and under identical conditions. The mean percentage of black in the three skins is 88.3.

This case may be seized upon in support of the protective coloration hypothesis, but I am still disposed to adopt the view expressed in the paper cited (1917, p. 180): ". . . . it seems more likely that the pale coloration of these mice stands in some more direct relation to the humidity of their immediate surroundings." Referring to the latter, I stated (p. 179): "Despite the nearness to the ocean and the high atmospheric humidity, the peninsula region seems dry in comparison with the redwood forests. This is due in part to the loose, sandy character of the soil—where, indeed, any real soil exists—and to the comparative lack of shelter from the prevailing westerly winds. Evaporation here is doubtless more rapid than in the comparatively stagnant air of the forests." I might have added that the humidity of their subterranean abodes, in which these mice are reared and spend the greater part of their existence, is almost certainly lower in the sandy region.

The case which has chiefly prompted the publication of the present paper is that of the alleged effect of black lava in darkening the pelage of certain rodents and other animals which make it their habitat.

In his well-known "Results of a Biological Survey of the San Francisco Mountain Region and Desert of the Little Colorado, Arizona,"[7] Dr. C. Hart Merriam mentions four different animals which were captured in the lava fields of this district, and which differed strikingly in color from their nearest relatives in the neighboring desert regions. These animals are (using revised nomenclature):

Citellus spilosoma obsidianus
Onychomys leucogaster fuliginosus
Perognathus flavus fuliginosus
Phrynosoma hernandesi

The first, a squirrel, was described as a new subspecies, the second (a true mouse) and the third (a pocket mouse) as new species. The last (a "horned toad") is referred to by Doctor Stejneger, who reported

[6] American Naturalist, March, 1917, June–July, 1918.

[7] U. S. Department of Agriculture. North American Fauna, No. 3. Washington, 1890.

upon the reptiles, as "a melanistic form."[8] In each case, considerable stress is laid upon the dark coloration of the lava-dwelling forms, it being more than once stated that we have to do with "protective coloration."

It may seem to be worse than reckless for one who has neither seen the specimens nor visited the locality under consideration to call in question such circumstantial statements by an eminent naturalist. It should not be necessary for me to explain, however, that the only point at issue is the interpretation of Doctor Merriam's findings. In view of the wholly negative results of my own investigations, to be described shortly, I think that I need offer no apology for questioning whether some interpretation alternative to that adopted by Doctor Merriam is not possible here.

Two such alternatives suggest themselves. The first of these is that the color correspondences observed were due to accident. Mice of the same species and subspecies are known to vary widely in color, pale and dark specimens being trapped in the same neighborhood. One may readily form premature conclusions from an insufficient number of specimens, owing to "errors of random sampling." In the present case, it is to be noted that the first of the four named species was represented in Doctor Merriam's collections by two specimens, the second by five (two being listed as "somewhat intermediate"), the third by a single specimen, and the last by two. Moreover, several of the specimens (including the single *Perognathus*) are listed as "immature," a circumstance which raises the question whether the darker shade of the pelage was not due, in part at least, to this fact.

One would naturally lay less stress upon this first alternative explanation, particularly since Mr. Vernon Bailey (as he informs me) is able to corroborate from his own observation these impressions regarding the darker pelage of certain rodents of the region in question.

A second possibility seems to be more worthy of consideration. It is to be noted that in the case of the mammals, at least, the darker race was taken in the "piñon and cedar belt," while the paler race, with

[8] It must be insisted that the case of the reptiles is quite different from that of the mammals in respect to adaptive coloration. Some lizards, as is well known, have chromatophores which are under the direct control of the nervous system, and are therefore capable of fairly rapid color adjustments. It may well be that many other species possess this power to a less striking degree. On the other hand, it would hardly be claimed that mammalian hair is subject to such influences.

which it was compared, came from the Desert of the Little Colorado. Now it is evident from both the maps and the text of the report, that the former region occupies a considerably higher altitude than the latter, there being an average difference of more than a thousand feet between the two. Indeed they are assigned to different life zones. While no meteorological records are accessible to me, it seems very probable that the precipitation in this belt of piñons and junipers on the mountain slopes is considerably greater than on the desert plains below. Are we, then, justified in eliminating humidity as the responsible factor in bringing about the color differences in these two localities? Or is it not, indeed, possible that some unknown third factor is the one chiefly concerned?

Certain other opinions regarding the effect of lava in determining the colors of rodents should be referred to before leaving this discussion. W. H. Osgood, in his valuable "Revision of the Mice of the American Genus Peromyscus"[9] tells us (page 16) that "if the range of a given form includes a few square miles of lava beds, specimens from that area show an appreciably darker color than the normal form occupying the surrounding region." Again (p. 70) "in northeastern California, the mice of the semidesert lava beds are more like the dark *gambeli* than the pale *sonoriensis*. Throughout the desert region *sonoriensis* is the prevailing form, except on the lava beds."

It is unfortunate that more specific instances are not given in support of these statements. We should like to know more of the rainfall, vegetation, etc., of these lava beds of northeastern California; likewise (and this is vitally important) their distance from regions in which true *gambeli* is abundant. Some of Osgood's other statements (pp. 16, 70) regarding the effects of narrowly localized environmental differences, apparently in the absence of any form of isolation, are not supported by the experience of various other collectors. They must, I think, merely voice impressions based upon accidental coincidences. The careful experiments of H. H. Collins (not yet published) show that the more marked color differences, occurring in a given locality within the range of a single subspecies, are hereditary and not due to any immediate environmental influence.

Goldman[10] has recorded observations similar to those of Osgood. Of one wood-rat, *Neotoma intermedia desertorum*, he writes (p. 77):

[9] U. S. Department of Agriculture. North American Fauna. No. 28. Washington, 1909.

[10] Revision of the Wood Rats of the Genus Neotoma. U. S. Department of Agriculture, North American Fauna, No. 31. Washington, 1910.

"Specimens taken in lava beds are usually darker than those inhabiting lighter-colored rock formations." Similar statements are made in respect to other species on pages 81 and 102. Unfortunately, we have no record of the number of individuals on which these statements are based, save that in the case of *N. lepida stephensi* but a single specimen was recorded from the lava beds. We likewise have no information as to the altitude, meteorological conditions, etc., of the particular lava fields where the species in question were trapped.

The chief direct evidence which I have to offer on the present subject was obtained during a collecting trip undertaken in the spring of 1920. The choice of locality was due primarily to the suggestions of Prof. Joseph Grinnell, director of the University of California Museum of Vertebrate Zoology. Doctor Grinnell, succeeded by Mr. Richard Hunt, of the same museum, together with the writer, constituted the field party.

The lava field on which the mice were trapped lies in the Mojave Desert some 12 miles west of the village of Ludlow, and just south of the main line of the Santa Fe Railway. Unfortunately, no Geological Survey or other reliable map of this region exists. The outline of the field is very irregular, the greatest length being perhaps five miles and the greatest width three.

Regarding the age of this eruption I can learn nothing definite. The lava, throughout much of the area, looks extremely fresh, and a beautifully preserved cinder-cone ("Mt. Pisgah") occurs near the northern border. On the other hand, there are, so far as I know, no hot springs, fumaroles or other evidences of recent volcanic activity in this part of the desert. Whether the age of the field is to be reckoned in hundreds or in thousands of years I am unable to learn from the geologists whom I have consulted.

The surface of this lava bed is raised well above the general level of the desert. It is extremely rugged and difficult of passage, being crossed in every direction by jagged ridges and yawning fissures. Sand has drifted in from the surrounding desert and become deposited in cracks and depressions, affording soil for the support of scattered shrubs and annuals, even a mile or more from the nearest border. Despite the presence of occasional sand pockets of considerable extent, the prevailing tone of the lava field is extremely dark. Viewed from neighboring hilltops it everywhere stands in extreme contrast to the pale sand and gravel which surrounds it on every side. Furthermore, it must be emphasized that the mice are not confined to the small

areas of pale sand, but appear to wander freely over the barest and blackest masses of lava rock, in which positions they were frequently trapped.

Preliminary trapping revealed the fact that there were several species of mice on this field. By far the most frequent was *Peromyscus crinitus stephensi*, but *P. maniculatus sonoriensis* and two species of *Perognathus* were met with.

Circumstances pointed to the first of the foregoing species as being best adapted for the test which I had in view. As is well known, this mouse shares the prevailing buff or sandy hue so characteristic of desert rodents. Furthermore, it has one very great advantage for present purposes, namely, that it is restricted in its habitat to rocky regions, in the crevices of which it finds its shelter. Here, then, we seemed to have the conditions favorable for a crucial natural experiment. This rather extensive lava field was surrounded on all sides by areas of sand and fine gravel. Trapping, undertaken to test this point, revealed the fact that the *crinitus* mice rarely, if ever, left the lava beds and strayed for any distance into the open desert. Live-traps, which I set for 175 "trap nights"[11] upon the desert areas adjacent to the lava field yielded but two specimens of *crinitus*, both of these within 150 feet of the lava. Furthermore, Mr. Hunt, during two weeks' use of spring traps in this region, did not catch a single specimen of this species away from the lava beds. In contrast to these negative results, it must be pointed out (1) that large numbers of mice of other species were taken in these sandy areas, and (2) that *crinitus* was extremely common throughout the lava field, where it predominated over all other small rodents. It would seem likely that for centuries, and perhaps for a vastly greater period, this colony of *Peromyscus crinitus stephensi* had been isolated by fairly rigid barriers from other mice of the same species.[11a] Since the statements of Merriam, Osgood and Goldman, cited above, relate to species and to localities concerning which no such claim of isolation is advanced, it would seem that in

[11] This useful unit of trapping activity is due to Grinnell (An Account of the Mammals and Birds of the Lower Colorado Valley, University of California Publications in Zoology Vol. 12, 1914, p. 92).

[11a] Doctor Grinnell suggests that "periodic eruptions" of these mice, due to over-population, might carry them, from time to time, across these barriers. I can only reply (1) that we have no knowledge of such migrations here; (2) that such a diffusion process is at least as likely to occur in those localities where a darkening effect of lava has been alleged.

the present case, if anywhere, the darkening effect of the lava would manifest itself.

Five hundred and thirteen trap nights on the lava field yielded me 157 specimens of *crinitus*, along with 23 specimens of mice of other species. From the former rather more than fifty skins were prepared. No selection whatever was made in choosing the individuals for skinning, save that mice with immature or with badly damaged pelage were rejected, while many others were unavailable owing to early decomposition.

The first results of this trapping made it plain that these mice belonged to no specially modified lava-dwelling race. They had retained the pale brown-gray hue, sprinkled dorsally with black, so familiar to us in desert rodents generally. When laid upon the dark lava rocks, they certainly could not be called inconspicuous, as the accompanying figure shows. (Plate 6.)

The fact that this seemingly conspicuous rodent flourishes in such numbers upon these lava fields gives us good ground for skepticism as to the need for concealing coloration among closely related species. And it surely justifies us in challenging those who assume without evidence the existence of a selection so rigid that trifling differences in shade are of frequent survival value.

It should also be mentioned here that none of the other species of mice and rats which were trapped upon this lava field by Mr. Hunt and myself gave any evidence of modification in the direction of deeper pigmentation. The species taken comprised one other *Peromyscus*, two species of pocket mice and a wood-rat. While no extensive series of skins was prepared for these other species, any very pronounced darkening would doubtless have been observed. With a single possible exception, the only noticeably dark pelages were those of juvenile specimens.

Although it was evident that no considerable degree of darkening had occurred among these lava-dwelling representatives of *Peromyscus crinitus*, the question still remained whether there had been any modification whatever, which might be revealed by careful quantitative methods. For this purpose a control set of specimens was necessary.

The control series I should naturally have collected in the Bullion Mountains, a rocky range, a few miles to the southwest, in which I knew that these mice occurred. But the presence of another extensive lava field upon the nearby slopes of this range, was regarded as com-

plicating the situation.[12] We therefore moved to a considerably more distant point. The spot chosen was a rocky range of hills near the village of Oro Grande, on the Mojave River, between fifty and sixty miles to the westward of our previous station. The new locality was some seven or eight hundred feet higher than the previous one, and perhaps differed somewhat climatically, as it did in respect to vegetation. It was, however, a typical stretch of desert country, and many of the more abundant plant species were common to the two regions. The hills along the base of which we trapped were covered with large masses of igneous rock, whose prevailing hues were pale gray, buff and pinkish, interspersed with areas of finer materials (gravel and sand) of a still paler hue. No lava fields or other extensive masses of dark rock occur in this vicinity.

One hundred and thirteen specimens of *P. crinitus*, together with thirteen belonging to other species, were taken in my live-traps in the course of 478 trap nights. Fifty skins were preserved, care being exercised, as before, that the choice of individuals should bear no relation to the color of their pelage.

A superficial comparison of this series of skins with that from the lava field revealed no obvious difference in their average color-tone. A careful quantitative study confirms this first impression. Indeed it seems rather remarkable that two random collections comprising such limited numbers, should agree so closely. The mean readings of the two series,[13] through the three color-screens of the Hess-Ives Tint Photometer, are as follows:

	RED	GREEN	BLUE-VIOLET
Lava	26.2	19.2	16.0
Oro Grande	26.7	19.4	15.9

[12] This second field is rather more than a mile distant (at the nearest point) from the "Pisgah" lava bed on which the trapping was done. The intervening area was occupied by level ground, entirely devoid of rock and likewise apparently of *Peromyscus crinitus*. Elsewhere, the "Pisgah" field is separated by much wider intervals from the nearest rocky hills.

[13] A few skins were rejected from each series owing to immaturity, or to obvious loss of hair. There remained 45 in the lava set, 46 in that from Oro Grande.

Reduced to terms of black, white, and color (in this case a shade of yellow) we have:[14]

	BLACK	WHITE	COLOR
Lava	79.8±0.19	16.0	4.2
Oro Grande	79.6±0.18	15.9	4.5

The trivial excess of black in the lava series is of no statistical significance, as appears from the fact that this difference is less than its probable error. It is to be noted that the lava series likewise shows a trivial excess of white, which is further evidence of the "accidental" character of all these slight differences between the two sets of figures.

Various objections may perhaps be brought forward by critics to the propriety of drawing any general conclusions from this single instance which yielded negative results. It will perhaps be pointed out that I have dealt with a wholly nocturnal animal. I should, it may be urged, have chosen some diurnal species, for which concealing coloration would be more necessary. In reply, I need only remark that two of Doctor Merriam's species (the *Onychomys* and the *Perognathus*) are as completely nocturnal in their habits as is *Peromyscus crinitus*, while the remarks of both Osgood and Goldman likewise apply to nocturnal species.

It may be urged, too, that the lava fields on which I have trapped my specimens are of unknown age and that they are perhaps much more recent than those of the San Francisco Mountain district. I cannot, I confess, meet this argument directly. It is certainly pertinent to point out, however, that the pale *crinitus* mice of this Mojave Desert lava field still succeed in maintaining themselves in great abundance, after a period which is certainly to be measured in centuries, and perhaps by even greater periods of time. This fact does not harmonize well with the assumed rigid selection on the basis of color-tone.

Another objector may insist that *Peromyscus crinitus* may, by reason of special habits, have no need for protective coloration, whereas the same may not be true of various other rodents. This, indeed, is quite possible. If it be true, however, we may well query why this species

[14] Those who have had no experience in color analysis may be surprised by my characterizing as "pale" a shade containing nearly 80 per cent of black. I will merely point out that a piece of faded khaki which I tested gave photometer readings very close to those for these mouse skins, but that the former was slightly darker.

has ever adopted the familiar pale hue, which seems to be an adjustment to the prevailing tones of the desert at large. Either way we take it, the argument seems to lead us into difficulties.

I am prepared, too, for the disparaging comments of such biologists as regard the experimental method as the only key to scientific truth. All this field observation, I may be told, is beside the mark. I should have subjected my animals to experimental tests in the laboratory. As a matter of fact, I have done this very thing, not with *Peromyscus crinitus*, to be sure, but with various subspecies of *maniculatus*. I have thus far found no evident tendency toward convergence on the part of these several races, even after a considerable number of generations in captivity under identical life conditions. Possibly photometer tests of prepared skins will reveal a slight change of color, but this is not yet obvious to the eye. The direct effect of humidity or other physical agents upon pigmentation, if such exists, must manifest itself very gradually in the case of these mice.

In conclusion, let me say that I make no claim that the single case which I have studied intensively affords a disproof of the effect of a lava background upon the coat color of every other mammal. But I do urge that the wholly negative result derived from this seemingly critical case, gives ground for reasonable skepticism, and that it throws the burden of proof upon those who have, thus far, offered us merely generalized impressions or very limited data.

Scripps Institution, La Jolla, California.

Peromyscus crinitus stephensi FROM LAVA FIELD, SEEN AGAINST A BLOCK OF DARK LAVA

Skin prepared by R. Hunt; photograph by H. R. Fitch. Reduced. The lighting conditions make the anterior half of the mouse appear somewhat too pale. Mus. Vert. Zool., no. 31393.

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THE "HAND-STAND" HABIT OF THE SPOTTED SKUNK

By Charles Eugene Johnson

In the Journal of Mammalogy for February, 1920, there appeared a note by A. H. Howell with regard to a Florida spotted skunk which he had suddenly met with, standing erect on its fore legs. Seton, in the following (May) number of the Journal tells of having seen a similar attitude assumed by the large northern skunk (*Mephitis putida*), when the animal apparently was in a playful mood. Since little seems to be known concerning this rather peculiar habit among skunks the following notes which I was fortunate enough to obtain a few weeks ago may be of interest.

On December 28, 1920, while in the field near Lawrence, I came upon one of the little spotted skunks (*Spilogale interrupta*), common in this region, which at the time was traveling leisurely across a wheat field. It was 11 o'clock in the forenoon and the day was very mild, the temperature being about 50°. When first seen the skunk was about 60 or 70 yards distant. I got out my kodak and gave chase with the intention only of securing a photograph.

When the skunk saw me as I came running toward it, it hastened its gait somewhat and arched its tail and waved it menacingly. I had set the focus at 8 feet and as I caught up with the skunk I dropped into a fast walk and then took a few quick steps toward it in order to get my distance. As I did so, but before I could properly aim the kodak and press the bulb, the skunk, which was proceeding at a rather slow, deliberate trot, suddenly threw its hindquarters into the air and actually ran a few steps on its fore legs. Its body seemed almost perpendicular and the hind legs were spread apart but were also drawn up somewhat toward the flanks; the tail was erect but drooped more or less over the back and sides and twitched threateningly. As the animal threw up its hindquarters it also turned slightly on its fore legs and twisted its body in an endeavor to face me. I stopped short but the skunk immediately dropped back to all fours again and continued running. In making further attempts to get a photograph of the animal I discovered to my great disgust that the shutter, long unused, refused to function properly, so that I ceased my efforts in this direction and gave my attention entirely to the skunk.

On three separate occasions while endeavoring to get a photograph of the skunk I quickly stepped up to within about 6 feet of it as it was running before me and each time the animal performed a perfect

"hand-stand" act. After my last futile photographic effort I stopped a moment to examine the shutter and the skunk meantime gained a little distance. I hastened after it and when near enough threw a clod of earth which struck the ground within a foot or two of its side. Like a flash the skunk threw up its hind legs and half faced about, pivoting on its fore legs, and uttered a hissing snarl. The "hand-stand" attitude, however, was not maintained for more than about half a second, the whole performance being but a momentary pause on the part of the animal to defend itself. Following closer after a brief interval I again startled it, this time by suddenly clapping my hands together and hissing. The skunk merely tossed up its rear to an angle of about 45° and kept on going.

We had now drawn near the edge of the field and desiring to experiment further I endeavored to head the skunk back in the direction whence it came. In this I succeeded for a time but only after much clapping of hands, hissing and various other outbursts on my part. In every instance when I got up rather close to the animal, within 8 or 9 feet to the best of my judgment, and suddenly startled it, it gave the "hand-stand" reaction. Altogether in the relatively short time that I was occupied with this experiment I induced about a dozen of these reactions. A number of times, when I was at a little greater distance, the skunk did not raise its rear so high from the ground; but on several occasions, when I suddenly stepped up close, the body was held in a perfectly upright position with the head straining toward the horizontal.

The last performance the skunk made before I let it go was the most interesting one, and of longest duration. Despite my efforts to prevent it the animal had succeeded in working its way nearer and nearer to the edge of the field where there was cover and where it evidently had a retreat, for it was headed toward this place when it was first seen. A number of times this little beast actually charged me as I stepped in front of it while trying to turn it back, but I retreated hastily and it did not press the pursuit. The last time, however, I held my ground as the skunk bristled and charged directly at me. When within probably 8 or 9 feet of me it stopped abruptly and elevated its rear end, standing perfectly balanced on its fore legs for what seemed at least a couple of seconds. It did not need to turn this time in order to face me; its back was toward me, and its tail drooped slightly over the back as it was waved from side to side in a deliberate but somewhat jerky fashion. The attitude was so erect that the vent was completely exposed to view from where I stood, and was directed upwards.

It seemed as though the animal was endeavoring to aim the charge over its back at me, its instinct to face the enemy being too strong to permit it to turn about and thus be in a more favorable position to direct its weapon.

My companion, who had remained an interested spectator from a little distance, declared afterwards that whenever the skunk rose upon its fore feet a fine spray of vapor could be seen issuing from the vent. This I did not observe, probably because of my proximity and the angle of view. I was perfectly aware of course that discharges were being made. The anal sphincter was actively working whenever the erect posture was assumed; that is, when the skunk was in a position so that the vent could clearly be seen.

After witnessing the above-described performance of the spotted skunk I am strongly inclined to believe that what has here by way of brevity been referred to as the "hand-stand" attitude is a common habit of this and perhaps also other species of skunks, under certain conditions. It is manifestly a defensive attitude primarily, and seems to be taken for the purpose of better directing the discharge of the vile secretion with which nature has provided these animals. The above noted facts are not sufficient in themselves to permit too many inferences or conclusions to be drawn from them, but they at least appear significant. The idea suggested itself that the erect attitude may possibly be resorted to by the skunk, and especially against such of its enemies as stand up higher from the ground, in order to aim the fluid at the most vulnerable part, namely the face. Against an intruder as tall as a man, at close range, there would seem to be no other way to effectively place its shot. Instinctively it is aimed at the face; and the higher the target the greater the elevation of the weapon. If it were attacked by a small dog it hardly seems likely that the skunk would elevate its body to the extreme that has been observed when on its defense against man, for that would be to overshoot the mark. On the other hand it may be that by assuming this attitude the skunk is able more quickly to surround its entire person with a defensive zone. But such points must be left for future observations or experiments to decide.

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ON THE GORILLA AND THE CHIMPANZEE

By C. R. Aschemeier

There have been several articles of late, in magazines and newspapers, regarding the gorilla and the chimpanzee, with particular reference to the bravery in an advance to the attack, as well as to the relative ability to defend themselves, shown by these great apes. The authors have, in some cases, belittled the gallant courage of the gorilla and pictured the chimpanzee as a brave beast. I wish to give an account of several instances when the gorilla proved himself the gallant; and to express my opinion that the chimpanzee is a coward, as compared with the larger ape. These are based on over two years' experience in hunting these animals in the Fernan Vaz District of the French Congo, which is considered the best region for both the gorilla and the chimpanzee.

Contrary to the opinions of many, the gorilla is, in my experience, just as intelligent as the chimpanzee. I found in every case that, in time of danger, the gorilla used his head better than did the chimpanzee. The latter ape seemed frequently to get "rattled," whereas the gorilla, although not necessarily slow, was, at critical times, much more deliberate in his actions. A chimpanzee always makes off at the first sign of danger, but one never knows when the gorilla may attack.

Their cries, in times of great danger, are characteristic of the natures of the two beasts. When I ran into a chimpanzee there was a wild scramble, a piercing scream, and the animal disappeared into the bush. With the gorilla it was quite different. There was usually a single yell, one that seemed fairly to make the earth tremble, and this was sometimes accompanied by a beating or thumping of the chest. The gorilla, in his deliberate retreat, usually keeps a tree between himself and the hunter.

I was a witness to several instances when gorillas refused to desert their fallen comrades. One morning on the Rembo Elandi, not far from our camp, we encountered a family party of five or more gorillas. Some of them, apparently, had not yet risen from their beds. One old male was on the ground, two were in the trees eating, and the rest were in the nest. One of my native guides advanced as far as was safe, actually to almost under the tree in which the two were feeding, and had the opportunity for close observation of what followed. I shot at one of these gorillas, an animal about two-thirds grown, and saw it tumble from the tree. I ran forward, to find the native standing in

surprise at what he had seen. Just as he was beginning his explanation, an old gorilla that had still remained in its bed arose and with a mighty yell retreated into the timber. The guide explained that the gorilla I had shot from the tree fell to the ground, apparently dead, but that another gorilla had rushed up, gathered it in his arms, and carried it into the bush.

Another time, Pambo, my best guide and helper, went into the bush with another native. Not long after I heard shots and very soon both natives came running, scratched from the bush and out of breath. They said that soon after entering the bush they encountered a large family of gorillas. Pambo said he shot a large female and that a male immediately approached in a very threatening manner, picked up the wounded female, and made off. On turning around the men saw another large male making at them. This one apparently meant business so they ran as fast as they could to get out of his reach.

On two occasions I captured young chimpanzees, but only once did I come near to getting a young gorilla alive. In this case a mother gorilla strayed a bit farther than usual while the baby was feeding. We had heard the animals in the bush, and were advancing cautiously when we saw the young one on the ground. We were closing in to capture it when suddenly we heard, on both sides, the swishing of bushes. Both parents were coming to the rescue as fast as they could. The smaller, presumably a female, went straight to the youngster, picked it up, and stood looking us full in the face. The old male arrived near these two very quickly, and on seeing us gave the terrible gorilla cry, and started off in the lead. As we followed, he dropped to the rear to guard the mother and young. This was one of several times, when the parents showed signs of willingness to sacrifice their own lives for the young, that I did not shoot.

I have frequently been asked as to the probable result in a combat between a gorilla and a chimpanzee. To begin with, one must take into consideration the weight, height, and reach of the two beasts. I shot two grown gorillas that measured five feet, one inch and five feet, three inches in height. The largest adult chimpanzee I got measured four feet and weighed about 150 pounds. The gorillas weigh from 300 to 350 pounds, practically twice as much as the chimpanzees. The chimpanzee is undeniably a strong beast, but the gorilla is just as strong, comparatively, and has the natural advantage of larger size and strength. I think that in the event of an encounter, the gorilla would by sheer weight and strength, wear the chimpanzee down. I

asked native gorilla and chimpanzee hunters which one was the most dangerous game, and the answer was always in favor of the gorilla. To get a real good close-up view of a live gorilla is a treat indeed.

Other questions often asked me on my return from Africa were: Do gorillas or chimpanzees capture native women and carry them off into the bush? And: Will the gorilla advance to attack unless he is wounded? As to the first question, I asked natives in all the localities I visited if such was the case and the answer was always in the negative. I saw several natives, both men and women, however, who had been badly wounded by gorillas. As to the second question, yes. I had gorillas deliberately advance on me and on account of the density of the brush I had to retreat. I found, though, that when a gorilla came at me it always gave up the chase in a little while.

U. S. National Museum, Washington, D. C.

THE RED SQUIRREL OF THE SITKAN DISTRICT, ALASKA

By H. S. Swarth

The red squirrel of southeastern Alaska was placed with *Sciurus hudsonicus vancouverensis* by J. A. Allen in his "Revision of the Chickarees," where *vancouverensis* was first described (Bull. Am. Mus. Nat. Hist., vol. 10, 1898, p. 269). The present writer, in a report upon a collection of birds and mammals from Vancouver Island, comments upon certain features that distinguish the red squirrel of southeastern Alaska from typical *vancouverensis* of Vancouver Island (Swarth, Univ. Calif. Publ. Zool., vol. 10, 1912, p. 88), without formally naming the Alaskan race. Further study of the red squirrels of the northwest coast region has emphasized the desirability of giving a name to this Alaskan form. It may be diagnosed as follows:

Sciurus hudsonicus picatus new subspecies

KUPREANOF RED SQUIRREL

Type.—Male adult, skin and skull; no. 8767, Mus. Vert. Zool.; Kupreanof Island, 25 miles south of Kake Village, at southern end of Keku Straits, southeastern Alaska; April 23, 1909; collected by H. S. Swarth; original no. 7281.

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[1] Contribution from the Museum of Vertebrate Zoology of the University of California.

Diagnosis.—A red squirrel with the general characters of *Sciurus hudsonicus*. Cranially, most nearly resembling *Sciurus hudsonicus petulans;* externally, more nearly like *S. h. vancouverensis*.

Comparisons.—*Sciurus h. petulans*, as compared with *vancouverensis*, is stated by Osgood (N. Am. Fauna, No. 19, 1900, p. 27, pl. V, figs. 1, 2) to have the "nasals longer and posteriorly more compressed than in *vancouverensis;* orbital arch with a sharp indentation between lachrymal and postorbital process." These differences do not exist between *petulans* and *picatus*. There are individuals in the latter series that show intergradatien toward *vancouverensis* in shape of nasals or in partial elimination of the orbital indentation described, but the series as a whole is, cranially, not to be distinguished from *petulans*.

As regards color, *Sciurus h. picatus* is dark as compared with *petulans*, but it is distinctly brighter than *vancouverensis*. The differences are most apparent in winter pelage; in the summer coat the two forms are closely similar in general appearance, differing only in certain minor details. In the winter coat *vancouverensis* is nearly uniform dark chestnut above, with the reddish dorsal stripe poorly defined; the tail is reddish above, but decidedly grayish on the ventral surface. In *picatus* the reddish color is generally brighter, there is a fairly well-defined hazel dorsal stripe and the center of the tail below is reddish. The black lateral stripe on the body is much more prominent. In all pelages *picatus* has the tip of the tail much less extensively black than is the case with *vancouverensis*. *Sciurus h. picatus* is slightly the larger of the two. For external measurements of *Sciurus h. picatus* and *S. h. vancouverensis* see Swarth, Univ. Calif. Publ. Zool., vol. 10, 1912, p. 88.

Distribution.—The area inhabited includes parts of the Sitkan district, Alaska, and extends for an undetermined distance southward. There are specimens at hand from the following islands: Kupreanof, Kuiu, Mitkof, Wrangell, Zarembo, Etolin, Revillagigedo, and Sergief. From mainland points: Taku River, Thomas Bay, Stikine River, Bradfield Canal, Chickamin River. (For details of distribution see Swarth, Univ. Calif. Publ. Zool., vol. 7, 1911, pp. 118, 153, map, fig. 1.)

Remarks.—The material upon which the above comparisons are made is as follows: *Sciurus h. vancouverensis*, 28 specimens from Vancouver Island (Mus. Vert. Zool.). *Sciurus h. picatus*, 36 specimens from the Alaskan localities previously indicated (32 in Mus. Vert. Zool., 4 in the E. P. Walker collection). *Sciurus h. petulans*, 17 from Glacier Bay (Mus. Vert. Zool.), 4 from Wells, Chilkat Valley (E. P. Walker collection).

The Glacier Bay specimens appear to be typical of *petulans*. The four skins from Chilkat Valley are, in color, intermediate between *petulans* and *picatus;* the skulls are not available. In his description of *petulans*, Osgood (loc. cit.) treats *vancouverensis* as a distinct species, a view that has since been disregarded (see Miller, List of North American Land Mammals, 1912, p. 321), and which my own material controverts. The race *picatus* is in itself intermediate between *petulans*

and *vancouverensis*, and in the *picatus* series there is individual variation tending to bridge the gap in either direction. The indentation in the orbital arch, given by Osgood as a feature distinguishing *petulans* from *vancouverensis*, is not a character to be absolutely relied upon. This little notch is sharply indicated in the *petulans* series, as I believe it is in the red squirrels of the interior of the northwest generally. In the Vancouver Island skulls at hand there are none in which it is at all deeply cut. In some it is entirely absent, but usually there is a suggestion of a notch at that point. The southern Alaskan series contains none in which the notch is as nearly eliminated as in most of the Vancouver Island skulls, and as a rule it is as apparent as in the *petulans* series. It is not a character the presence or absence of which can be indicated in each of the skulls; it appears in all degrees from one extreme to the other.

Berkeley, California.

REVISED LIST OF THE SPECIES IN THE GENUS DIPODOMYS[1]

By Joseph Grinnell

A bare list of names is a pretty poor offering, not ordinarily worth printing. But in the present revised list enumerating sixty species and subspecies of kangaroo rats a good deal of new information is set forth in a concentrated form. The main basis of this contribution is a relatively extensive systematic and distributional study of the genus as occurring within the limits of California. The more comprehensive report upon this study is likely to be long delayed in the press, if, indeed, it ever sees the light of publication.

The 33 forms now known to occur in this state (California) have been determined upon after examination of a large amount of material, over 2800 skins with skulls. Confidence as to their status is much greater than with most of the remaining forms, of which material has been accessible in only scant amount. Still, first impressions, as gained of the latter, may be worthy of consideration, when gathered upon the basis of the rather intensive study of the other forms.

The "*ordii* group" is accepted practically as revised by Goldman (Proc. Biol. Soc. Washington, vol. 30, 1917, p. 113).

[1] Contribution from the Museum of Vertebrate Zoology of the University of California.

The species are arranged by "groups" from what appears to be the most generalized type to the most specialized. These groups are not at all comparable in rank to the subgenera currently recognized in some other families of rodents; in fact the genus *Dipodomys* as it stands seems to be remarkably compact and homogeneous. Yet the groups indicated do serve to express probably more close genetic relationship among the constituent species of each group than that obtaining between species representing different groups.

HEERMANNI GROUP

Dipodomys heermanni heermanni LeConte
Dipodomys heermanni californicus Merriam
Dipodomys heermanni eximius Grinnell
Dipodomys heermanni tularensis (Merriam)
Dipodomys heermanni dixoni (Grinnell)
Dipodomys heermanni berkeleyensis Grinnell
Dipodomys heermanni goldmani (Merrian)
Dipodomys heermanni jolonensis Grinnell
Dipodomys heermanni swarthi (Grinnell)
Dipodomys morroensis (Merriam)
Dipodomys mohavensis (Grinnell)
Dipodomys leucogenys (Grinnell)
Dipodomys panamintinus (Merriam)
Dipodomys stephensi (Merriam)
Dipodomys ingens (Merriam)

SPECTABILIS GROUP

Dipodomys spectabilis spectabilis Merriam
Dipodomys spectabilis cratodon Merriam
Dipodomys nelsoni Merriam

PHILLIPSII GROUP

Dipodomys phillipsii Gray
Dipodomys perotensis Merriam
Dipodomys ornatus Merriam
Dipodomys elator Merriam

MERRIAMI GROUP

Dipodomys merriami merriami Mearns
Dipodomys merriami ambiguus Merriam
Dipodomys merriami atronasus Merriam
Dipodomys merriami parvus Rhoads
Dipodomys merriami simiolus Rhoads
Dipodomys merriami arenivagus Elliot

Dipodomys merriami melanurus Merriam
Dipodomys nitratoides nitratoides Merriam
Dipodomys nitratoides exilis Merriam
Dipodomys nitratoides brevinasus Grinnell
Dipodomys platycephalus Merriam
Dipodomys margaritæ Merriam
Dipodomys insularis Merriam
Dipodomys mitchelli Mearns

ORDII GROUP

Dipodomys ordii ordii Woodhouse
Dipodomys ordii columbianus (Merriam)
Dipodomys ordii monoensis (Grinnell)
Dipodomys ordii utahensis (Merriam)
Dipodomys ordii chapmani Mearns
Dipodomys ordii obscurus (Allen)
Dipodomys ordii montanus Baird
Dipodomys ordii longipes (Merriam)
Dipodomys ordii luteolus (Goldman)
Dipodomys ordii richardsoni (Allen)
Dipodomys ordii palmeri (Allen)

COMPACTUS GROUP

Dipodomys compactus True
Dipodomys sennetti (Allen)

AGILIS GROUP

Dipodomys agilis agilis Gambel
Dipodomys agilis simulans (Merriam)
Dipodomys agilis peninsularis (Merriam)
Dipodomys agilis cabezonæ (Merriam)
Dipodomys agilis perplexus (Merriam)
Dipodomys venustus venustus (Merriam)
Dipodomys venustus sanctiluciæ Grinnell
Dipodomys elephantinus (Grinnell)

MICROPS GROUP

Dipodomys microps (Merriam)
Dipodomys levipes (Merriam)

DESERTI GROUP

Dipodomys deserti Stephens

Certain names which have been bestowed upon kangaroo rats will not be found in the above list for the reason that they are considered by the present reviewer as applying to forms named previously. These synonyms, and their allocations, are as follows:

helleri of Elliot = *deserti* of Stephens
kernensis of Merriam = *merriami* of Mearns
mortivallis of Elliot = *merriami* of Mearns
nevadensis of Merriam = *merriami* of Mearns
nitratus of Merriam = *merriami* of Mearns
pallidulus of Bangs = *californicus* of Merriam
similis of Rhoads = *simiolus* of Rhoads
streatori of Merriam = *heermanni* of LeConte
trinitatis of Kellogg = *californicus* of Merriam
wagneri of LeConte = *agilis* of Gambel

These cases have been worked out at some pains and are reasonably certain. There are very likely a few names in the main list above that will eventually have to be synonymized also. But on the other hand there are undoubtedly many more good new forms to be named. So that future systematic workers in this interesting genus will find much yet to do.

Berkeley, California.

DESCRIPTION OF A NEW SPECIES OF PHENACOMYS FROM OREGON

By A. Brazier Howell

[*Plate 7*]

Among some skins with uncleaned skulls, which were kindly loaned me for study by Stanley G. Jewett, was a *Phenacomys* which appeared to belong to a new species; and after the skull was cleaned all doubts of this were removed. Mr. Jewett has generously given me permission to describe this new form, which may be known as

Phenacomys silvicolus new species

FOREST LEMING-MOUSE

Type.—Young adult female; No. 1214, Coll. of S. G. Jewett; 5 miles southeast of Tillamook, Tillamook County, Oregon; October 25, 1916; collected by Peter P. Walker; Orig. No. 40, Coll. of Alex. Walker.

Diagnosis.—Externally, closest to *Phenacomys longicaudus*, with a general appearance and tail very similar to that form; but darker and with smaller ears. The skull is longer than that of *longicaudus* of corresponding age, with narrower braincase having temporal ridges, with much heavier molariform teeth of a different pattern, and with pterygoid plates which flare anteriorly on their outer edges.

Description.—The hairs on the back of *silvicolus* are fine and long, some of them reaching a length of 15 mm. The bases are plumbeous, and the distal ends sayal brown, sparsely tipped with black. The coloration is slightly paler on the sides, and rather abruptly white on the ventral surface, the hairs of the latter area having plumbeous bases. The feet are soiled whitish with long toes and claws as in *longicaudus;* and the tail is covered with long, blackish hairs as in that species. The ears are small and do not project beyong the body hairs.

The skull is quite different from those of *P. orophilus*, *P. albipes*, or *P. longicaudus*. In comparison with the last-named species, which is evidently its closest relative, the skull of *silvicolus* exhibits the following characters. The braincase is flattish, long and comparatively narrow. The nasals are somewhat constricted at a point posterior to the middle, with the ascending extremities of the premaxillæ narrower. The zygomatic processes of the maxillæ slope rather evenly from the rostrum, and the zygomatic width is greatest in the anterior region of the jugals, with the latter converging somewhat posteriorly. The temporal ridges are very pronounced and are parallel in their posterior halves, thence joining the vertical ridges of the squamosals. The postorbital processes of the squamosals are poorly developed and are not "peg-like." The incisive foramina are large and are not in the least constricted posteriorly. There is a distinct "hump" at the juncture of the basi-occipital with the basi-sphenoid,

and the anterior portion of the latter is very narrow, forming considerable vacuities between it and the pterygoids. The pterygoid plates are unusual in that they gradually form lateral shelves anteriorly, and the interpterygoid fossa is wide, with the palatal pits more pronounced, although smaller, than in *longicaudus*. The audital bullæ are slightly larger.

The molariform teeth are even heavier and broader than in *orophilus*, with the tooth row considerably longer than in *longicaudus*. The teeth are further characterized by the wide, sweeping lines of the enamel folds, and by the tendency of all the molar angles in the lower jaw to remain open. This species of *Phenacomys* is unique in having not more than three closed triangles in $\overline{M1}$. There are no closed triangles in $\overline{M2}$, and the antero-external loop is wide open. $\overline{M3}$ is simple and somewhat as in *longicaudus*. The upper molariform teeth show no notable peculiarities in the enamel pattern.

Measurements.—Type: Total length, 191[1] mm.; tail, 81[1]; foot, 32[1]. Length of skull, 25.1; zygomatic width, 14.4; interorbital width, 3.4; mastoid width, 11.8; upper molar row, 5.9.

Remarks.—The type specimen was found dead on a log on a ridge which is covered with first-growth Douglas fir (*Pseudotsuga taxifolia*). The writer spent several weeks in this region during September, 1920, and, with the generous coöperation of P. P. Walker and A. Walker, to both of whom he is deeply indebted, made a search for this animal. All convenient patches of second-growth fir were searched for nests, and many hundreds of traps set without result. Virgin timber was also examined, but with very little hope of success, for the trees are so large, and so festooned with long moss, that each might contain a score of hidden nests.

P. longicaudus is the only species of the genus that is definitely known to lead an arboreal life. Also, it was previously the only known form with a long, *hairy* tail. Our knowledge of the habits and characters of other families (e.g., Sciuridæ) gives us grounds for presuming that hairiness of tail may be considerably increased by a life in the trees. The tail of *silvicolus* is just as hairy as is that of *longicaudus*, and, in addition, both have toes and claws that are unusually long and well fitted for climbing. Hence, it is a logical conclusion that one species is just as arboreal as the other.

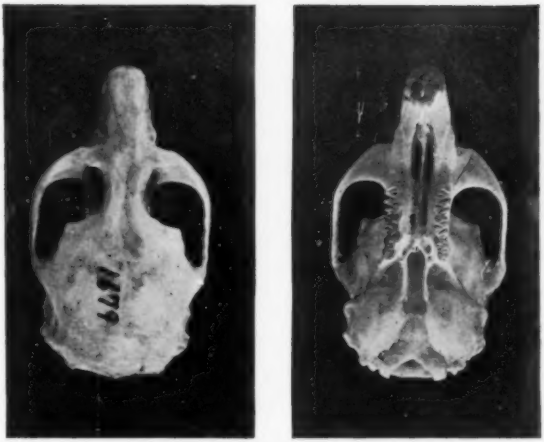
Mr. Jewett informs me that *longicaudus* has been taken as far north as the Columbia River, so this form probably occurs in scattered colonies throughout the coast district of Oregon. The type locality of *silvicolus* is typical of all the humid, timbered area of that state, and one may presume that the new species is rather widely distributed.

[1] Collector's measurements; that of the foot is obviously an error and should be 22 mm.

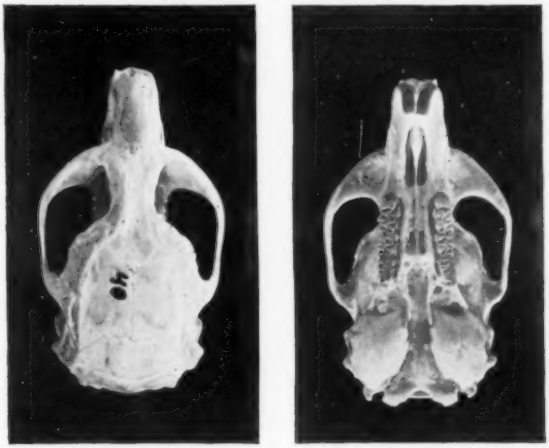
Therefore, the two species may well occur together, for although both are undoubtedly arboreal, they may occupy different ecological niches, and have different food habits. It is interesting to note that *P. albipes* is found on the floor of these humid forests, its association seeming to be definitely riparian, and thus there are three distinct species of this genus inhabiting the same faunal area—a condition that is, so far as known, unique.

The relationship of *silvicolus* is not clearly indicated. As mentioned, the external appearance places it with *longicaudus*, and it is probably closest to that form, but its skull does not resemble skulls of *longicaudus* to any greater degree than it does skulls of *albipes*, and the apparent similarity may be due solely to the influences of parallel habits acting upon two separate stocks.

Pasadena, California.



SKULL OF *Phenacomys longicaudus*. × 2



SKULL OF *Phenacomys silvicolus*. TYPE. × 2

UNIV. OF MICH.

NOTES ON THE SNOWSHOE RABBIT

By J. Dewey Soper

To the average lover of the open, the life-history of the snowshoe rabbit cannot have escaped a certain measure of familiarity. Usually it is the most common animal of the woods and it would be difficult for even a casual saunterer to overlook it. There has sprung up quite an extensive literature concerning it, and it seems impracticable for the present purpose to attempt a full account of its life-history. So I propose only to amplify certain less frequently considered phases. This idea came to me recently from thumbing through the pages of some old field journals, recalling to mind many incidents pretty well dimmed by the passage of time, but now revived, together with a host of minor episodes not recorded by the pen. It has many times occurred to me as peculiar that some of the most palpable of facts escape the notebook. Perhaps it is because of the very quality of commonness that this is so, and only the unusual facts find their way into the chronicles of the fields.

Most of the notes in this instance were collected in the wilds, in the Indian country, in the late fall and winter, and as previously intimated, I enjoy a very vivid recollection of numerous occurrences which various wayward journeyings have afforded. I also have found discrepancies in the life of the snowshoe rabbit there, from that which ordinarily obtains in the settled East sufficient to compel that striking interest which follows fresh discoveries.

The lives of the various individuals of a species are very different, depending largely upon their situation. The relationship of a hare to its environment in an eastern swamp, encircled by prosperous farms, for instance, cannot be precisely similar to that of another in the relatively uninhabited forests of the North. Its mode of existence basically may be nearly or quite the same, but occasional events change the effect as a whole. These may be trifling or the reverse but the consequences are perceptibly altered from the standpoint of the animal, and a fresh slant of interest afforded its chronicler. For this reason, I suppose, a very great deal may be written concerning any of our animals of wide range, without materially duplicating in detail former experiences.

It would be difficult to visit the northern wilds under ordinary conditions without striking up some acquaintance with the snowshoe rabbit. Its presence is often of the most obtruding character. There are seasons though when its absence becomes quite as singular as is its abundance at other times. The phenomenal balance maintained in the perpetua-

tion of this species is one of the wonders of nature. The marvelous fecundity of the animal as seen in the usual seven-year cycle of abundance, seems a reflection on the beneficence of nature, when such numbers subsequently are so effectually reduced. But without some provision for reduction the final consequences would be rather appalling. It is certain that in time all herbaceous things would disappear. The country would lie in devastation before the progeny of such a prolific race. Of course if this did occur the balance would be struck again when the rabbits all passed away in starvation, but nature proceeds in a more cautious manner without such waste on both sides.

It so happened, that upon my first visit to the West in 1912 the rabbit population was at its height. It was such a revelation after my eastern experiences, so startling, that the vividness of their abundance can never leave me. A certain brushy flat adjoining the White Mud River, southwest of Edmonton, yielded the initial surprise. It was grown to scrub willow, the common trembling aspen, and to some extent with rank under-vegetation. The place was infested. I do not hesitate to say that over that tract of perhaps thirty acres hundreds of hares were found. October had come, without snow. The rabbits had already, wholly or in part, donned their snow-white livery of winter, and were consequently very conspicuous against the mellow brown of the autumn woods. At every turn during my ramble they popped up here and there and scurried for fresh cover. Not only in singles, which was astonishing enough, but often twos and even threes started up in wild alarm. The newness of such an experience does not soon wear away. One receives a peculiar thrill at each additional incident. Scarcely has one received the impression of the previous fleeing object than perhaps another startlingly rockets out from nearly underfoot, stirring up several more in the haste of evacuation. After the first wild impulse of flight which is generally deferred until the last moment, the rabbit bounds leisurely away, sometimes out of sight but as often calling a halt within a few yards. Alarm gives place to a very singular curiosity. Individuals with really admirable nonchalance describe a dozen leisurely jumps, halt, assume an attitude of keen inquiry, a rigid immobility popularly known as "freezing," and wait. That pause is oftentimes fatal. They appear bold or indifferent because of their very numbers. These snowy figures like statues in the distance form one of the features of a woodland ramble.

Over the country to which these remarks broadly refer, namely, the northern and western parts of Alberta, the rabbits often become a

plague. The toiling trapper, depending on the effectiveness of each of his traps, they drive to a form of desperation.

Night after night along the whole long line the cubby or bait pens are torn down or in some way molested. The bait frequently disappears, the traps are sprung, and in a good many instances (sometimes half of them) the rabbit sacrifices his life to his curiosity. The traps thus set

THE SNOWSHOE RABBIT

These snowy figures like statues in the distance, form one of the features of a woodland ramble

for costly fur-bearers are consequently rendered useless—filled with "trash" as it is regarded. The best that can be done is to remove the rabbit carcass from the "set," wedge it overhead in a forked tree, make all additional provisions against the blundering in of others, and resume chances. I can vouch for it as being rather disheartening work for I have taken as high as a dozen hares from a line of twenty lynx traps in a single morning. There is a method of adjusting a fine bent twig under the pan of a large trap to prevent the smaller species from springing the trap, but the idea is not practical except when employed on the

largest traps. The reason for all this tampering with meat baits by rabbits, leads to a subject which, I believe, is not widely known and to which I will refer later.

Eventually, evidence of the inevitable decline arrives. Empire among the rabbits as elsewhere has its rise and fall, and then is swept away. A strange peril stalks through the woods; the year of death arrives. An odd rabbit drops off here and there, then twos and threes, then whole companies die, until the appalling destruction reduces the woods to desolation. There is something almost spectacular in its compass, in its silent and sinister progress. I have walked the woods where formerly hundreds of playful rabbits dwelt, where signs were evident on every hand, yet the woods were empty. A peculiar sense of loneliness comes over one under such circumstances. One year (1917) in the district of Sudbury, northern Ontario, the signs of rabbits were everywhere but not a single rabbit could I start. It seemed incredible. Local inquiries disclosed that a little over a year before the *Lepus* population was beyond count. Now as if by magic they were gone. Needless to say, however, a few individuals survive the epidemic. These now, because of their paucity are seldom encountered. The following year at Ridout, same locality, I observed a noticeable increase. Not that they were plentiful or even common, by any means, but there were frequent trails in the early snow and I started occasional animals. In these few existed the prophecy of another dominion.

There is such a sense of sociability in a wilderness well stocked with these animals, that a subsequent lack of them is at once appreciated. One is sensible of a loss. In the same way the moose bird with his quaint talkative ways becomes one of the presumptive elements of a camp. One night while we were camped near the Athabaska, with a mere square of canvas sufficient only to deflect the wind, it snowed, a calm fluffy fall of several inches. It fell over and about our sleeping forms and in the morning imprinted in it were the tracks of rabbits all around us. They had nosed up to every conspicuous object about camp—the water pail, ax, overturned boots, etc., had even kicked the ashes of the extinct camp fire over the snow and eventually to their satisfaction I presume had solved the enigma of this sudden encampment in their midst. Several trails completely circled our camp. At the time we were entirely unconscious of these frolics. On other occasions morning betrayed their fearless errands about camp, during which they had actually browsed on a quantity of spruce boughs placed to resist the wind at our heads. Again we knew nothing of it until day-

light. Small wonder it is, that the winter wilderness seems less empty and forlorn with such antics of the wild ones about one's habitation.

After the completion of our new log cabin on the Hay River, Rocky Mountain region, in 1913, the rabbit population soon discovered us. The aromatic wealth of spruce boughs that littered the little clearing spread its fame abroad. Perhaps never before in this region had hospitality spread such a lavish *table d'hote*. As dusk descended rabbits came hopping into the enclosure from every direction. There was no evidence of their presence beyond the silent flitting forms passing lightly from place to place. With only the soft sombre wail of the pines and spruces how phantom-like they seemed in the gloaming: now prominent, now melting into the shadows, now motionless, now shifting here and there, spectre-like in the sober stillness. One sparkling moonlight night they visited the clearing in unusual numbers. It was such a night as carried the "yip" of the foxes over long distances with startling distinctness. In the deeper shadows of the spruces an owl mournfully hooted at long intervals. A strange magic charged the brilliant frosty night. One by one they capered into the zone of moonlight. All seemed imbued with a spirit of festive joviality, doubling about with playful pranks and short sallies of wild abandon but ever and anon returning to the sumptuous feast.

Observed from the cabin window, this pantomime went constantly on; the revelers seemed never to tire. Some fed, some frolicked as in games of tag, but a rigid alertness never for a moment ceased. Always one or more of the company sat erect on its haunches, alert, ears forward, nose aquiver, sifting the implications of the night. One ominous sound or sign was enough to scatter this merry assemblage to dark and distant shadows. When one watcher went down another was already acting as sentinel. Still new arrivals came hastening along the ramifying trails. It seemed probable that the entire rabbit population within a wide radius were conscious of this regal occasion. At one time we counted twenty-five in easy view; double that number were possibly present, some hidden behind the piles of boughs or in the shadowy outskirts of the moonlight. Fresh arrivals there were always; and some departures. To calculate accurately their numbers was impossible. When we turned in for the night they still played, and perchance the pallid dawn and the waning moon alone ushered them back to the shelter of the thickets. Truly it was a rare scene and one which tonight, after seven years, lingers in my memory as though it passed but an hour ago.

Wa-poos, as the Crees call him, plays a very important part in the Indian diet, besides furnishing the skins from which their famous rabbit-skin winter robes are made. In the many instances in which I have had occasion to visit Indian wigwams, winter cabins, or in coming accidentally upon their shifting camps, signs of the defunct hare were almost always present. Such bones and feet and fur as had escaped the hungry dogs bestrewed the near landscape. When we arrived at the Fish Lakes in early October, 1913, a number of Indian youths were stalking about in the thickets bordering the lake and outlet hunting snowshoe hares with the primitive bow and arrow. Nor did they lack the skill to get them. The Indian seldom wastes ammunition in getting the hare, the main dependence being placed in the snare. Invariably, in fall and winter at least, as one approaches an encampment large or small, the rabbit snare is conspicuous. A small spruce lies prone, a few branches lopped out underneath forms an opening, and in this reposes the treacherous snare attached to a balance pole secured to a neighboring tree. *Wa-poos*, sniffing the fresh-fallen spruce as invariably he does, nibbles and hops along. Then coming to the inviting lane in the tangle, he dives through, releases the snare and is jerked aloft, a grotesque kicking figure soon to be silenced forever. The snare is a very simple arrangement and very effective. Perhaps a score may be scattered about the camp to a distance of fifty or more yards, further afield if it is a permanent camp. I carefully took note of the structural peculiarities of this snare as employed by the Crees and early pressed it into service on my own account as a means of providing bait for a long line of traps. During the period of trial in which several snares were doing duty about my cabin, an Indian spied one while passing the clearing. I chanced to be near, and the pleasure he evidenced in this work of emulation was an entertainment seldom afforded among this people. His stoical countenance became transfigured with half-a-smile as he turned with some such expression as *Me-wa-ne-pa-hou* (good to kill).

Few animals are considered more strictly vegetarian than the rabbit, yet occasionally it develops tastes to the contrary. This at first was quite a surprise to me. It has no capacity however for gratifying such carnivorous inclinations by any effort of its own, except that of killing young leverets which it is supposed at times to do. On the contrary, any meat which it has access to under ordinary wilderness conditions is supplied by some outside agency. The habit of robbing trap cubbies of bait leads to various consequences. I have known them to demolish a cubby of wooden chunks completely in the effort to reach a frozen hindquarter of one of their own species. The entrances to these cub-

bies intended for ermine and designed to exclude the hare are so small that they really adopted the only method serving to attain their object. Especially when yielding to cannibalism do they appear to go far beyond proper bounds. The flesh of one of their own kind is fully as acceptable as any other. Frozen meat they seem to prefer. When one of their number is killed say by a rifle ball, and left lying, the living of the locality turn to and make a sordid repast. They start from the wound by licking away the blood, gradually nibbling the flesh and tearing the fur back. I cannot recall ever having seen a perfect body molested, such as one taken from a snare. It appears that a wound or tear exposing the flesh is necessary before a start is made. So accurately does the following published letter to Ernest Ingersoll reflect my own experiences in this respect that I can do no better than quote it for additional detail.

Dear Editor: I read with interest "U. S.'s" letter to you in the issue February 13 concerning Animal Cannibalism as noticed by him among wild rabbits.

I can endorse every word he says about dead rabbits being regularly eaten by their own kind in this part of Canada. It is a common occurrence on bright evenings to see rabbits about my shack, or near the stables gnawing at any dead rabbits or part of one left in the snow; and as a rule, very little is left of the carcass in the morning except the skin and bones. They will, however, rarely touch a whole rabbit left with the skin on but one that is torn, cut up, or partly skinned they make short work of. They will also eat any other animal with the skin off, as anyone who has done any trapping for weasels, etc., in the far north well knows. Baits are regularly pulled down and eaten up to the bone; and the trouble here is stopping the little cannibals from springing your traps. The rabbits in this district are healthy enough, and have no lack of food in poplar bark, hay, etc., but they never fail to gnaw the flesh off the bones of a dead comrade, and have done so, to my personal knowledge ever since I came into this country six years ago.

As you seem to have a doubt on the matter I may add that my experience is also the experience of my friends and neighbors, and no question of mistaking tracks in the snow can arise, as anyone can watch the rabbits any evening enjoying a supper of flesh by just throwing down near the haystack the cut-up carcass of another rabbit, muskrat or any other small animal.

Clyde, Alberta. F. B.

In passing I wish to make reference to the peculiarity of this species in taking to the water. I think this habit is little recognized as of actual occurrence, much less as one practiced more or less regularly, and free from the nature of accident. Although the evidence is indubitable on this score I instinctively feel that this essentially woodsy and fluffy creature resorts to such measures only on rare occasions. However this may be, it is certain it has no hesitation at times in voluntarily swimming rivers of modest width. Just how frequently such aquatic

excursions are made, remains of course unknown. The trouble is, that in summer there is lack of sign and in winter the necessity no longer exists. Ocular evidence can occur only as a rarity. Occasionally one comes upon "sign" such as the following.

While traveling one winter day down the Hay River in western Alberta I came to a narrow part of the course where the constriction of the banks forced the water to greater speed. Here there was an open riffle of several hundred yards in length by about four or five in width. Otherwise, ice covered the entire river. This rift of dark swift water in mid-channel raced along at about eight or ten miles an hour. Presently in the fresh fallen snow I noticed the tracks of a snowshoe rabbit, leading down from the timber on my left, across the shore ice, and terminating on the brink. Walking down stream I solved the puzzle by seeing a sodden splash in the snow on the further side where the animal had been swept down and had clambered out dripping from the plunge. The tracks were then resumed across the white snow field, disappearing in the woods beyond. This was the first time I ever noticed this occurrence, was indeed the first intimation that a rabbit ever even wet its feet unless forced to do so. The nature of the trail in this instance proved it to be an action of leisurely choice. No fox or ermine trailed along in the wake of a wild bounding hare ready to submit to water rather than to jaws, for back trailing I found nothing calculated to urge the rabbit from its own placid ramble. To our ordinary everyday conception of its nature the whole affair seems a paradox. I know I was utterly taken back at the time, but was forced to accept the evidence of my own eyes. Since then I have heard or read of similar observations by others. I have, by the way, in years since, known red squirrels to do the same thing. On one other occasion a couple of years ago in New Ontario, I had further evidence of the hare's accomplishment as a swimmer. The conditions were similar to the incident already related.

When such things at times crop up and tax our credulity on a basis of unimpeachable evidence, how eloquently it argues for untraveled byways in nature which we have yet to explore. There is something vital in the reflection that there are puzzles to solve, occultisms to stumble upon. When such phases in the life-history of our native mammals, thought previously to be well understood, suddenly appear from the unknown or what we consider as the improbable, what absorbing facts, perhaps, remain still to be learned from the lives of the hunted.

Guelph, Ontario.

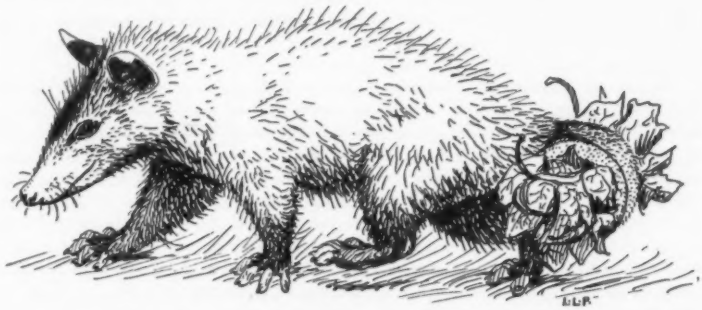
GENERAL NOTES

OPOSSUM IN VERMONT

A full grown opossum was caught by A. A. Roberts, a professional trapper, at Dorset, Vermont, in the heart of the Green Mountains, in mid-December, 1920, long after the ground and streams had become frozen. The skin was seen by the writer. It was lightly furred, indicating that perhaps the animal had been in captivity, but inquiries in the locality and an item placed in local newspapers failed to locate any person who had had one of the animals as a pet. I can find no other record for the taking of this animal in Vermont, which is far north of its usual range.—GEORGE L. KIRK, *Rutland, Vermont.*

OPOSSUM CARRIES LEAVES WITH ITS TAIL

A number of years ago five living opossums were sent to the Field Museum of Natural History from southern Illinois. In the lot were one nearly grown female and four young, not her own, about the size of large house rats. After arrival they were kept temporarily in a wire-covered barrel. The second night the large female literally "ate alive" one of the young, and afterwards forced her escape from the barrel. She had eaten the hind quarters of the unfortunate youngster without first killing him, as attested by his contorted carcass and awful facial grimace when found cold and stiff next day.



After this episode I kept only one young opossum alive, in order to make a few studies from life of so curious a mammal. When the fall days began to grow cold I gave this fellow a thick carpet of autumn leaves in his box cage. Though he ate heartily of meat scraps, fruits, and vegetables, he was not contented. When not sound asleep in his favorite corner he pounded solemnly around and around his cage like a wild tiger, with a funny preoccupied look on his grinning face. One morning when I glanced into his cage I was surprised to see him pacing around his beat with a large bunch of leaves tightly rolled up in his long, prehensile tail. He carried this bundle so long, around and around in tireless pace, that I left him without learning the object of his action. Later he repeated

this carrying of a bundle of leaves in his tail a number of times. I noticed that he had made a half hearted attempt to build a nest in one corner, but had abandoned the idea and slept anywhere that he happened to be when drowsiness overcame him.

Opossums of course use their tails with agility in climbing, but I have never seen a note in mammalian history on the use of the tail as a carrier of material of any kind, so thought this account might prove of interest to readers of the Journal. The accompanying sketch shows accurately the manner in which the tail was employed in carrying bundles of leaves.—LEON L. PRAY, *Field Museum of Natural History, Chicago.*

NOTES ON THE EUROPEAN HEDGEHOG

Extracts from my journal, written at Ultuna, Sweden, 1898: *August 4.* A member of the faculty of the Agricultural College, located here, informed me that every night a hedgehog (*Erinaceus europæus*) was seen to leave a thicket near the campus, and make for the shrubbery along a small stream, where it fed during the night. We went out that evening to watch for it, and had about given up seeing it, when we heard a woman talking and found her in earnest conversation with the hedgehog. It stood a few feet away gazing at her, but on seeing us turned and ran under a building where it was captured. It did not roll up until I had handled it roughly. I was told that these animals fed on mice, berries, and scraps thrown from the kitchen.

August 5. Among the twenty-five specimens caught today, were two *Erinaceus*. One was taken in a steel trap baited with bread and set by the side of an out-building; the other in a Schuyler rat trap set in a barn and baited with rolled oats.

August 11. Last night I caught another *Erinaceus* in a steel trap baited with rolled oats. . . . . A half-grown hedgehog that I keep in my room shows displeasure, when disturbed, by sniffing through his nose and making a noise in his throat that sounds like heavy heart-throbs. Occasionally he shakes himself, ratting his spines. When placed on a couch, he shows fear of falling, creeps cautiously to the side, lies prone, and peeps over the edge. I offered him bread and boiled potatoes, and, though he accepted them, he took a piece of raw meat much quicker. At first he started to roll up, but, on scenting the meat, uncoiled, accepted and ate it very slowly, all the time grating his teeth. He does not use his front feet while eating. Whenever I handle him he rolls up so tightly that it is difficult to find the opening. He does not attempt to bite [he did later however] even when I catch him before he is tightly closed and tickle his belly. I have just induced him to walk six inches to my hand and take a piece of raw meat from my fingers.

August 12. My pet *Erinaceus* is very interesting. He eats the bodies of both *Sorex* and *Neomys*, chewing the meat fine and eating slowly. It took him eight minutes to eat a half grown *Microtus*. Last evening I knocked from a table, and broke, a glass candlestick; and during the night the hedgehog awakened me by rolling one of the pieces about the floor. Then he began scratching on the side of the chamber vessel and I chased him away, but he returned and I had to remove the vessel in order to sleep. He is very active. I can call him from

the far side of the room by tapping on the carpet with my fingers and when he comes up, possibly with the expectation of being fed, he shows his displeasure by snuffing and butting at my hand. Whenever I try to pick him up he hugs the floor, sniffs, and butts sidewise at my hand. A bowl of drinking water on the floor he tipped over on its side, and then, putting his nose against it, rolled it about the room; went away, but came back and repeated the performance several times. These animals seem to be incapable of digging. I have had six of them for over a week confined in a wire enclosure built on the ground and they have made only feeble attempts to dig out.

August 15. Notwithstanding that I have been told repeatedly that hedgehogs eat berries greedily, I have not succeeded in coaxing my pet to do so, although there has been a handful each of strawberries, huckleberries, and squawberries in a corner of the room for two days. When he sleeps, unless he is confined in a small space, he does not roll up, but lies on his side half coiled like a dog.

August 17. My little *Erinaceus* spent the day—dark and rainy—running about the room. He stands high and at any sudden noise, such as the slamming of the door or dropping of a book, jumps nervously. At the first sign of danger he squats, ducks his head, and throws the spines on his head forward preparatory to rolling up. Several times he has bitten my fingers but it is never more than a hard pinch. I gave him a small *Microtus* and two *Sorex* and in eating the last *Sorex* it took him exactly sixteen and a half minutes. I have just finished making up the skins of five adult animals of this species. Adhering to the skin on the back, and between the fat on the body and the skin, is a sheet of fleshy muscle an eighth of an inch in thickness which terminates abruptly and is much thicker at its outer edge. This fleshy muscle, covering the area occupied by the spines, is similar to that found on the skin of a porcupine and probably is for the purpose of erecting the spines. A broad and much thicker band of muscle encircles the entire body at a point where the spines and the hair unite. It passes over the top of the head and acts as a puckering string when the animal curls up. To do this, he simply ducks his head, humps his back, and contracts the muscle band. By placing my fingers against his belly and tickling until he curls up, I can distinctly feel this band. Last night my pet managed to climp up on the bed and wakened me by sniffing and butting sidewise against my cheek.—J. ALDEN LORING, *Owego, N. Y.*

SHREWS AND WEASELS

It is pretty generally known that most animals, both wild and domestic, will not eat the short-tailed shrew (*Blarina*) and the distaste for the little mammal seems to be shared by the weasel. Is the aversion mutual?

In December the writer had a trap set for weasels under a brushy fence. The place was infested with blarinas and they were attracted to the rabbit bait and caught regularly. A weasel will take almost any kind of bait in the form of flesh, but tracks in the snow showed that if a Bonaparte weasel approached the trap when it held a shrew, it kept at a distance of four inches and refused to touch the bait. The *Blarina* was removed and the next morning the trap held a weasel. The snow indicated that blarinas had run back and forth under the brush several times but the weasel was untouched. White-footed mice and field mice (*Peromyscus* and *Microtus*), which had previously been caught in the trap, were almost entirely consumed by the shrews.—GEORGE L. KIRK, *Rutland, Vermont.*

THE HOG-NOSED SKUNK (CONEPATUS) IN COLORADO

The middle of December, 1920, Mr. C. E. Aiken of Colorado Springs, Colorado, showed me the skin and skull of a skunk which had been brought to him for mounting, and which was at once recognized as a species of *Conepatus*, a genus hitherto unreported from Colorado. This specimen was taken by Mr. Sam. Keaton near his ranch on Little Fountain Creek, some twelve miles southwesterly from Colorado Springs, at the edge of the foothills. Mr. Keaton has lived on this place from his boyhood, since 1873, and while he has trapped *Mephitis* and *Spilogale* there, he had never before seen a skunk like this, and recognizing it as something new, was afraid to shoot it for fear of injuring it too much, therefore threw stones at it, chased it, and finally threw himself down upon the animal and strangled it with his hands. This was some time between the first and tenth of December, 1920.

Mr. Aiken, who has kindly consented to my publishing this record, gave me permission to send the specimen to the Biological Survey for identification, and I received two letters from Mr. E. W. Nelson, chief of the Survey, concerning it. In one he remarks that the record from a locality so far north is a very interesting and surprising one, the most northern one in the Biological Survey files being from the vicinity of Albuquerque, New Mexico. In the second letter, written a few days later, after the specimen had been compared with material in the Biological Survey collection, he states that the animal is a young one, and is provisionally referred to *Conepatus mesoleucus mearnsi* Merriam.

If the specimen is a young one, and it certainly appears to be small, it would seem possible that a litter may have been raised in that locality and that there may be more there. And this brings up the question as to whether this, or its family, if there is a family, is merely a straggler, or whether the hog-nosed skunk is extending its range to the northward and until now has escaped notice. The locality is somewhere about the boundary between the Transition and Upper Sonoran zones.—Edward R. Warren, *Colorado Springs, Colo.*

THE ELEPHANT SEAL OFF SANTA CRUZ ISLAND, CALIFORNIA

I was recently asked to identify a strange creature that had been seen by one of the fishermen plying out of the harbor of San Diego. The man stated that his boat was about five miles southwest of the south end of Santa Cruz Island when he encountered a large school of herring, which were followed by a number of whales and the usual school of albicore. As the boat arrived on the scene a strangely weird animal appeared from the depths, rearing its head a yard or more above the waves, only a hundred feet from the fishermen. After staring at them for a moment it sank with a splash and reappeared some hundred yards distant. The description was so accurate that there is very little doubt but the animal was a large male elephant seal, *Mirounga angustirostris*. This record would seem to give credence to a report that came to me about a year ago, of a seal of this species being shot off Santa Catalina Island.

Fifty years ago the elephant seal was abundant on the Channel Islands and as far south on the Mexican coast as about 26° north lat. Constant persecution reduced its numbers, until twenty years later it was considered nearly, if not

quite extinct. A small colony, living on Guadaloupe Island, escaped destruction, though raided on several occasions, and from late reports there would seem to be a few scattered remnants to remind us of this once abundant species.—A. W. ANTHONY, *Nat. Hist. Museum, Balboa Park, San Diego, California.*

MICE AND CHIPMUNKS HELP RESTOCK FORESTS

Mice and chipmunks are helping to reestablish the forests of Oregon and Washington, according to officials of the Forest Service, United States Department of Agriculture. Studies made by J. V. Hofmann, director of the Wind River Forest Experiment Station at Stabler, Washington, have shown that a large part of the young fir growth coming in on burned or logged areas in these States is not wholly due to seeding by occasional trees which are left, but in part to seed buried by small rodents beneath the duff of the forest floor.

In the West mice and other rodents are usually condemned as workers of evil in the forest. They often do considerable damage to food supplies, and their appetite for pine and fir seed is chiefly responsible for the abandonment of attempts to reforest burned-over and waste areas by direct seeding methods. Sometimes, however, the work of these little animals is beneficial.

"In the Douglas fir region," says Mr. Hofmann, "the forests produce a heavy seed crop every two or three years. Rodents collect the seed from the cones in large quantities and bury them just beneath the surface of the soil. Part of the seed thus stored away is eaten, but snow and soil movement often cover many of the hoards so that they are never found. When logging operations open up the stand, these seed germinate and produce a new stand of little trees."

The Wind River Experiment Station is but one of several similar establishments maintained by the Government in the national forests for solving forestry problems. In this particular case many thousands of dollars have been saved annually to western lumbermen through the assistance of rodents in restocking cut-over lands. This is one example of the value of the experiments being carried on by these stations, which are so important to the perpetuation of our forests and dependent industries.—U. S. DEPARTMENT OF AGRICULTURE PRESS SERVICE, *Washington, D. C.*

A RECENT MIGRATION OF THE GRAY SQUIRREL IN WISCONSIN

In a previous paper I have noted a migration of northern gray squirrels (*Sciurus carolinensis leucotis*) across the Mississippi River from Wisconsin into Minnesota during the autumn of 1905. The migration may have been caused by a shortage of nuts on the Wisconsin side of the river (Bull. Wisconsin Nat. Hist. Soc., vol. 8, p. 87, 1910).

On a field trip for the United States Biological Survey during the past summer (1920), I had occasion to visit Pepin, Wisconsin. While there, Mr. Broach, a reputable citizen of that village, told me about a migration of gray squirrels which occurred early in the fall of either 1914 or 1915. The squirrels came from the hills 2 or more miles back of Pepin, followed a point out into the foot of Lake Pepin, and there swam a distance of about ¼ mile across the Mississippi River to the Minnesota shore. Mr. Broach would give no estimate of the number

of squirrels but said "there was a continuous movement, and possibly an average of two entering and two emerging from the water every few minutes for about a day." Mr. Broach stated that there was no food shortage of the Wisconsin side of the river, there being an abundant crop of acorns, nuts, and corn.—HARTLEY H. T. JACKSON, *U. S. Biological Survey, Washington, D. C.*

CÆSARIAN OPERATION ON LEPUS ALLENI, AND NOTES ON THE YOUNG

On March 13, 1920, a female *Lepus alleni* was shot on the Santa Rita Range Reserve, south of Tucson, Arizona, for breeding record. When the body was opened, three very large foetuses were discovered, and after a little hesitation it was decided to open the uterus and note the condition more definitely. No sooner was this done with the first than on the freeing of the head the young animal began to breathe precisely as if normally born. After a little further hesitation, which nearly resulted fatally for the third youngster, it was further decided to release all of them and see whether they would survive. This was done as quickly as possible, with the result that in a few moments all three were lying across the warm body of the mother in the sunshine, breathing normally; and in a surprisingly short time attempting to find a nipple for nursing. In actual fact, the first one released from the amnion was attempting to suckle before the third one was fully freed. No bleeding whatever occurred when the umbilical cords were cut although this was done immediately on releasing them from the membranes, which fact would indicate that they must have been normally born within a very short time, probably within the ensuing twenty-four hours. As the eyes were open from the first, there can be no doubt that they are open at normal birth in this species.

The sun was bright and warm, the hour being 10.00 a.m., and there was scarcely a perceptible breeze, so that no difficulty was experienced in keeping the diminutive jacks warm until they were thoroughly dry. In the meantime they kept close up against the now cooling body of the mother, whose nipples they repeatedly sucked upon. However they evidently secured no milk, as none would hold to a teat for more than a few seconds.

Some photographs were taken of them alongside the body of the mother, after which they were wrapped carefully and taken to camp on the seat of the car. Here for a few hours they were kept warm and contented in the sunshine and were fed a small amount of milk from a spoon. During the afternoon they were taken on a forty mile trip to Tucson, and established in a box with plenty of old woolen blanket for warmth. After several attempts to feed them in various ways an ordinary pipette was found to be most satisfactory. About five pipettes full of warm cow's milk, amounting to from 8 to 10 cc., constituted a feed during the first day, and three feedings per day were decided upon after some observation. The second day condensed milk, diluted with an equal quantity of water, was substituted for fresh cow's milk.

Owing to the fact that very little exposure would chill the little animals, measurements were not taken on the first days of life. All were weighed however, and the weights were 108, 103.5, and 90 grams, respectively, at noon of the day they were taken. In spite of every care and the use of the same food, the smallest did not thrive from the first as the others appeared to do. It ate as much

but was not so active, and did not make the gain in weight and activity which was at first noticeable in the others. By March 18, the fifth day, it would no longer take food to any extent. The larger ones by this time would drink avidly about 15–20 cc. at a feeding. In fact this small individual was so nearly dead on the evening of this day as to justify killing it.

During the next two or three days, first one and then the other of the remaining two became ill, and in spite of all attempts to save them with dietary variations the second died at the close of the eighth day, and the third on the tenth day. A mother cat with a kitten the same age as the young rabbits was located at a neighbor's the seventh day and the two rabbit babies were offered to her and at once accepted, but this proved to be too late to save either of them. It was felt that had she been discovered early in the week the rabbits might have been successfully reared, and it is hoped to secure again at some future date the young of this species for observation throughout the growth period, and to secure a cat as foster mother.

On March 18th the remaining two were measured as accurately as possible with results as follows:

	Length	*Tail*	*Foot*	*Ear*
No. 1	150 mm.	8.0 mm.	40 mm.	37 mm.
No. 2	150 mm.	8.5 mm.	45 mm.	40 mm.

A marked tendency to nocturnal habits was noted on the second day of life, and this became more marked in succeeding days. This was evidenced in the fact that not one of the three would accept milk at noon, after a morning feeding. However, by 4.30 or 5.00 p.m. food was readily accepted, and again at night from 9.30 to 10.30. Indeed the alertness and activity of all was much more marked at this hour than during any of the daylight hours, which latter were spent in sleep. Even when effort was made little activity could be aroused, and no interest in food was ever shown at midday. In the night, however, as soon as coverings were removed the young rabbits would quickly rouse up, raise heads, erect the ears, and crawl or hop about and search for food. On the night of March 17 when a light was switched on at a few minutes after ten o'clock, I was much surprised to see the two larger ones emerge from the coverings with ears erect, hop to the side of the box nearest me, and make an effort to climb out. This was in fact easily accomplished by the first, which could barely reach the top edge of the small box from the blanket on which it stood.

The incisor teeth of these specimens were so well developed that bits of lettuce, apple and other fresh succulent vegetables were offered them, but no interest whatever was manifested in such foods. It is a source of regret that the desirability of saving the skulls was overlooked until too late. The pelage was well developed, the young being so fully clothed from the first in short fur as to give no impression of the semi-nakedness seen in so many young mammals born with partially developed pelage.

In coloration the young were typical *alleni* as to the ears, with their posterior edges of white, and as to general ground color, except that they were perhaps a trifle darker than the average adult. Each had a small but distinct white spot in the center of the forehead, which is not present in the adult. The white of the side and belly was never drawn up on the back and side during the few days

the young were under observation, a movement so characteristic of the frightened adult as to have caused this species to be known as the "antelope jack-rabbit." —CHAS. T. VORHIES, *University of Arizona, Tucson, Ariz.*

DATES OF SHEDDING OF HORNS IN YELLOWSTONE PARK

During the season of 1919–1920 the dates of shedding of horns by wild antelope, elk, and deer in the Yellowstone National Park, Wyoming, were as follows: Prong-horn antelope, October 20 to November 25; elk, March 19 to May 4; white-tailed deer, January 15 to February 20; and mule deer, January 6 to March 25. Horns from many weak and decrepit elk and deer fell much earlier than usual, and that is the reason for the early dates above. The lack of vigor of these animals was due, of course, to the hard winter and want of suitable food.—M. P. SKINNER, *Yellowstone National Park, Wyoming.*

SHED HORNS OF THE AMERICAN ANTELOPE

The following notes were brought out by the article on the horns of the antelope in the May, 1920, Journal of Mammalogy from the pen of Mr. Vernon Bailey and were sent to him as a private letter. It has been suggested that they are of enough interest to be printed in the Journal. What they tell has been known to certain observers for many years, but has perhaps not been published.

Thirty or forty years ago, when antelope in their range were enormously abundant, shed horn sheaths were often seen on the prairie. Usually, they were in bad condition. Many years ago, at my request, Capt. L. H. North made an experiment which showed that these horn sheaths offer little resistance to the weather and are very perishable. I think it was in December in the late '70s—probably 1878—that he killed, in western Nebraska, an antelope, from whose head as it fell both horn sheaths dropped off. Mr. North put the sheaths together, and noted the spot, and now and then through the winter in his range riding looked at the horns. In the early summer they began to split and crack, and in late August or September following, when we last looked at them, they had practically disappeared, and there remained only a few long black splinters of horn. The hard tips were recognizable when carefully looked for, but no one who was passing by on foot or on horseback would have noticed that there was anything lying on the ground. In those days, food was far more abundant on the prairie than of late years. Even then no doubt coyotes may have gnawed the antelope horns, but many of them were left untouched.

Since in those early days the antelope was the most abundant and most universally distributed large mammal on the plains, it was one of those most frequently killed for food. When a buck antelope was killed, late in the season, it often happened that if one took hold of the horn to turn the head so as to cut the animal's throat, the horn sheath slipped off in the hand. The new horn below was always hard at the tip, but for only a short distance back from the end. It was covered almost to the tip with long growing hairs, somewhat as shown in Mr. Bailey's figure 1, plate 8, in the Journal of Mammalogy. The hard black end of the sheath was very short and the hair clothed skin extended almost up to the end of the sheath.

As time went on, the black, hard tip of the horn extended further and further down toward the head—the hair apparently coalescing to form this black horn—and the active growing hairy skin surface toward the base of the horn became more and more reduced in vertical length.

We know little, as has been said, about the process of shedding and renewing these horn sheaths; but for many years I have believed that at the close of the rutting season, say early in October, the periosteum of the horn core becomes more active and thicker, takes on the character of the body skin, hairs begin to grow from it rapidly, and as these hairs grow the old horn sheath is pushed away from the core and up and off the sheath. The result of this is that by late fall or winter the whole horn sheath is loosened and ready to drop off.

In old times hunters trying to save their antelope heads occasionally carried the skulls tied—often by the horns—to the wagon bows or wagon axles, and sometimes lost skulls or horn sheaths or both, because if the periosteum of the horn core began to decay, the sheath slipped off and was lost. Even at the period of the rut, if the sheath were separated from the horn core, fine hairs were seen growing from the skin on the horn core.

The season for the shedding of the horn sheaths is late fall or early winter, the time running from November 15 to the end of December.

The rut takes place two months earlier—during September—and at this time there is much fighting among the males, though I have never seen anything like the account given by Audubon, which of course he received from others. Often the fighting does not become an actual battle, but one of the males rushes at another which turns and runs, to be pursued by the stronger for a mile or more.

Sometimes, however, there is actual contact and the antelope come together, head on, with a certain amount of violence, and then push hard for two or three minutes, when the weaker, by a swift sidewise bound and turn, saves himself from the horns of the stronger and runs. It is possible that the shock of the horns coming together might have a tendency to loosen the horn sheaths.—Geo. Bird Grinnell, *New York City.*

FIELD SUGGESTIONS

For one reason or another, it is sometimes advisable while on a field trip to carry small mammals "flat" instead of making up the skins on the spot. If the following suggestions are adopted the final preparation of the specimens will be materially facilitated. Leave in all the leg bones, for it is sometimes difficult to relax the feet to the extent where wires can be inserted. Leave the specimens inside out and then prepare a small cardboard form of the shape used for stretching cased furs, over which the skin should be drawn, care being taken that the ears are not left pointing forward. Cut a notch in each side of the form so that the posterior edges of the skin will be caught by them and prevented from shrinking unduly. This cardboard may be cut an inch longer than necessary and the data written upon it. Finally, the usual tail wire should be wound with cotton, dipped in arsenic, inserted, and then bent back over the skin, so the tail will be out of the way. Unless this is done it is often impossible to relax the tail sufficiently to allow a wire to be inserted without causing the hair to slip. I have sometimes worked for an hour over an especially refractory tail.—A. Brazier Howell, *Pasadena, California.*

RECENT LITERATURE

Gregory, William K. Studies in Comparative Myology and Osteology: No. IV.—A Review of the Evolution of the Lacrymal Bone of Vertebrates with Special Reference to that of Mammals. Bull. Amer. Mus. Nat. Hist., vol. 42, pp. 95–263; 196 text figs. and 1 plate. December 4, 1920.

This important contribution to the literature of mammals "has partly grown out of a difference of opinion between Dr. J. L. Wortman" and the author "concerning the probable course of evolution of the lacrymal bone in Primates." In the introduction is a "Synopsis of the classification of the vertebrates adopted in this work," including the lower vertebrates, fishes, amphibians, reptiles, birds, and mammals. "The present classification of the mammalia has grown out of the classification adopted in 'The Orders of Mammals' (1910, Bull. Amer. Mus. Nat. Hist., XXVII) and is intended to reflect the chief advances of the last decade in this subject." The arrangement of the orders in this new classification is as follows; the extinct groups have been marked † (by the reviewer).

†Protodonta
Monotremata
†Triconodonta
†Multituberculata (Allotheria)
Marsupialia
†Trituberculata
Insectivora (Centetoidea, Soricoidei, Erinaceoidei, Pantolestoidei)
†Tillodontia
Carnivora (including Pinnipedia)
Cetacea
Artiodactyla
†Amblypoda
†Embrithopoda
†Pyrotheria
Proboscidea
Sirenia
†Condylarthra
Tubulidentata
†Litopterna
†Notoungulata
Hyracoidea
Perissodactyla
Edentata
Rodentia
Lagomorpha
Dermoptera
Chiroptera
Menotyphla (the tupaioid "insectivores")
Primates

Following other introductory matter is an account of the lacrymal region in mammals, with numerous drawings to illustrate the text, and with much interesting discussion as to the origin of various groups. In his "Summary of the evolution of the lacrymal bone," the author says that the present study "lends strong support to the so-called 'Cuvierian concept:' namely, that the lacrymal of mammals is the homologue of the lacrymal of the Crocodilia, as named by most authors up to the time of Gaupp and Jaekel, who, on the contrary, held that the Cuvierian concept was erroneous and that the lacrymal of mammals had been derived from the so-called prefrontal of reptiles."

The last section of this work, "The lacrymal problem in its phyletic and taxonomic aspects: a phylogenetic review of the vertebrates," is of particular interest, and Doctor Gregory at the outset remarks that "the elements of the lacrymal complex being relatively few in number, it is not surprising to find more or less similar combinations sometimes occurring independently in widely different groups, so that in such cases a similarity in the pattern of the lacrymal region does

not denote near relationship." The unhappy results obtained by Knottnerus-Meyer in his attempts to classify ungulates by the characters of the lacrymal bones alone, might have been mentioned in this connection as an example of the dangers to be encountered in the complete reliance on any one part of the structure of an animal as a sure guide to its affinity.

—*N. Hollister.*

Matschie, Paul. Neue Ergebnisse der Schimpansenforschung. Zeitschr. f. Ethnol., vol. 51, pp. 62–82. 1919.

This paper is based upon the author's recent studies on 322 skulls and 159 skins of the chimpanzee. In the critique of the features that have been claimed in the literature to distinguish the chimpanzee from other apes many interesting statements are found: the length of the arm varies to a great extent in the different species of chimpanzee; there are forms in which the arm is as long as in many orang-utans. The outer ear of the chimpanzee is said to be larger than that of the gorilla. This rule, however, has many exceptions; there are chimpanzees whose ears are only 40 mm. long, and in Kamerun there is a gorilla with ears at least 42 mm. in length even in the young animal. The crista sagittalis on the skull, often held to be typical for *Gorilla*, is missing in a great many females of this ape and is found among the chimpanzees in the Tschego and some species of the Congo and Ogowe regions. The nasal bones, which according to Keith, reach farther down in the gorilla than in the chimpanzee, are at times of greater relative length in the latter than in the former. The author finds that the gorilla is distinguished from the chimpanzee by the fact that the nasalia are more than twice as broad at their lower as at their upper ends, and also by the second last upper molar, which is at least 13 mm. in breadth and 12 mm. in length, while in the chimpanzee it is at most 12 mm. in breadth and 10 mm. in length.

A good deal of space is devoted to the description of many different species and races of chimpanzee, among which the author proposes some new ones, e.g., *Anthropopithecus schneideri* and *A. papio.*

—*A. H. Schultz.*

Eggeling, H. Inwieweit ist der Wurmfortsatz am menschlichen Blinddarm ein rudimentäres Gebilde? Anatom. Anz., vol. 53, pp. 401–428. 1920.

The largest part of this paper is devoted to a description of the caecum and, where it is to be found, of the appendix in primates. The latter is present in apes and in *Stenops* and *Chiromys* of the Prosimiæ; it is missing in catarrhine as well as platyrrhine monkeys. The paper contains interesting extensive tables on the length of the different regions of the intestinal tract of primates.

—*A. H. Schultz.*

Buller, A. H. Reginald. The red squirrel of North America as a mycophagist. Trans. British Mycological Soc., vol. 6, part 4, pp. 355–362, September 22, 1920. (The red squirrel of North America is an habitual mycophagist. In the late autumn it often collects fleshy fungi in large numbers for its winter supply of food; and it stores these fungi sometimes *en masse* in holes in tree trunks, old birds' nests, etc., and sometimes separately on the branches of certain trees.)

CARHART, ARTHUR H. Forest oddities—the bighorns of Ouray. Amer. Forestry, vol. 27, pp. 37–38; 3 figs. January, 1921. (Tameness of the protected mountain sheep at Ouray, Colorado.)

DICE, LEE RAYMOND. The land vertebrate associations of interior Alaska. Occasional papers Mus. Zool. Univ. Michigan, no. 85, 24 pp., 4 plates, May 25, 1920. (Nineteen associations mentioned, all of which except 3 contain mammals.)

——— The mammals of Warren Woods, Berrien County, Michigan. Occasional papers Mus. Zool. Univ. Michigan, no. 86, 20 pp., 2 plates, June 24, 1920.

DUNN, L. C. Linkage in mice and rats. Genetics, vol. 5, pp. 325–343, May, 1920 (September, 1920).

——— Independent genes in mice. Genetics, vol. 5, pp. 344–361, May, 1920 (September, 1920).

——— Types of white spotting in mice. Amer. Nat., vol. 54, pp. 465–495. November–December (December 6), 1920.

FESTA, E. Il Nyctinomus taeniotis (Raf.) in Piemonte. Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 35, no. 735, pp. 1–3. November 15, 1920.

GREGORY, WILLIAM K. Facts and theories of evolution, with special reference to the origin of man. Dental Cosmos, pp. 1–19 (of reprint). March, 1920. (Lecture delivered before the annual meeting of the Eastern Association of Graduates of the Angle School of Orthodontia, New York City, May 5 and 6, 1919.)

——— Studies in comparative myology and osteology; No. V. On the anatomy of the preorbital fossæ of Equidæ and other ungulates. Bull. Amer. Mus. Nat. Hist., vol. 42, pp. 265–284; 1 plate, 26 figs. December 4, 1920.

GRIFFITH, COLEMAN R. The effect upon the white rat of continual bodily rotation. Amer. Nat., vol. 54, pp. 524–534. November–December (December 6), 1920.

GUNTHORP, HORACE. Pulsation of a cat's heart after death. Science, n.s., vol. 53, p. 92. January 28, 1921.

HAUSMAN, LEON AUGUSTUS. Hairs that make fabrics. The microscopic identification of mammal hairs used in the textile industry. Scientific Amer., vol. 122, no. 8, pp. 184, 200, 202, 204. February 21, 1920.

——— A micrological investigation of the hair structure of the Monotremata. Amer. Journ. Anat., vol. 27, pp. 463–495, September, 1920.

——— Structural characteristics of the hair of mammals. Amer. Nat., vol. 54, pp. 496–523, 199 figures. November–December (December 6), 1920.

HINTON, MARTIN A. C. *Paraonyx*, a new genus of clawless otter discovered by Capt. J. E. Philipps, M.C., in Central Africa. Ann. and Mag. Nat. Hist., ser. 9, vol. 7, pp. 194–200. February, 1921. (*Paraonyx philippsi* gen. et spec. nov., from British Ruanda. The *Aonyx capensis congica* of Lönnberg is also included in the new genus.)

HORNADAY, W. T. Restore the Burchell zebra. Zool. Soc. Bull., vol. 24, no. 1, pp. 18–20. January, 1921.

HOWELL, ARTHUR H. Description of a new chipmunk from Glacier National Park, Montana. Proc. Biol. Soc. Washington, vol. 33, pp. 91–92. December 30, 1920. (*Eutamias ruficaudus*, sp. nov., from Upper St. Mary's Lake.)

HRDLIČKA, ALEŠ. Shovel-shaped teeth. Amer. Journ. Phys. Anthr., vol. 3, pp. 429–465. December, 1920. (Contains notes on the teeth of mammals.)

IBSEN, HEMAN L. Tricolor inheritance. IV. The triple allelomorphic series in guinea pigs. Genetics, vol. 4, pp. 597–606, November, 1919 (February, 1920).

JACKSON, CLARENCE M., AND CHESTER A. STEWART. The effects of inanition in the young upon ultimate size of the body and of the various organs in the albino rat. Journ. Exper. Zool., vol. 30, pp. 97–128, January, 1920.

JONES, F. WOOD. The external characters of pouch embryos of marsupials. No. I—*Trichosurus vulpecula*, var. *typicus*. Trans. Royal Soc. South Australia, vol. 44, pp. 360–373, plates 14, 15, 1920.

KING, HELEN DEAN. Studies on inbreeding. IV. A further study of the effects of inbreeding on the growth and variability in the body weight of the albino rat. Journ. Exper. Zool., vol. 29, pp. 71–111, August, 1919. (Based upon the growth and variability in the body weights of 296 males and 310 females belonging in the sixteenth to the twenty-fifth generations of two series of albino rats that were inbred, brother and sister from the same litter. Seemingly, inbreeding has as yet produced no deterioration in the original albino stock as regards the rate and extent of growth in body weight.)

LOMEN, CARL J. Hearings before the Committee on Ways and Means, House of Representatives, on reindeer meat, January 21, 1921. Tariff Information, 1921, Washington, Government Printing Office, pp. 1–25. 1921. (Statement by Mr. Lomen, and briefs on the reindeer industry in Alaska filed with it.)

LUCAS, FREDERIC A. The unicorn and his horn. Nat. Hist., vol. 20, pp. 532–535. December, 1920.

MACDONALD, ROSE M. A question of bibliography. Science, n. s., vol. 53, pp. 74, 75. January 21, 1921. (Reply to query by A. Willey for information as to what "Mr. Lockhart" is quoted in Coues' Fur-bearing Animals.)

MAY, HENRY G. Observations on the nematode genus Nematodirus, with descriptions of new species. Proc. U. S. Nat. Mus., vol. 58, pp. 577–588, pls. 29–35. December, 1920. (This genus of nematodes inhabits the intestines of sheep, cattle, goats, deer, camels, and rodents. One species, *Nematodirus neotoma*, inhabits the small intestine and stomach of woodrats from Colorado, the type specimens having been taken from *Neotoma cinera rupicola*.)

MAYER, CHARLES. Trapping an elephant herd in Trengganu. Asia, vol. 20, pp. 1055–1058, December, 1920. (An account of trapping a herd of 60 elephants in a stockade.)

——— How Sir Elephant mastered the herd. Asia, vol. 21, pp. 27–32. January, 1921. (Explains in story form methods of taming or "breaking" elephants. Contains many valuable data on habits of elephants.)

——— Long chances in the animal dealer's game. Asia, vol. 21, pp. 154–159, 168. February, 1921. (Account of shipping 5 elephants by steamboat. Notes on habits of elephants. Account of trapping a live rhinoceros.)

MICHL, EDUARD, Beitrag zur Entwicklungsgeschicte vom *Bos taurus* L. Anat. Anz., vol. 53, pp. 193–215. August 20, 1920.

MIRANDA RIBEIRO, ALIPIO DE. Os veados do Brasil segundo as collecções Rondon e de varios Museus nacionaes e estrangeiros. Revista do Museu Paulista, vol. 11, pp. 209–307; 25 plates, 1 map. 1919. (Largely discussion and quotation of earlier authors. *Odocœlus suaçuapara*, apparently a variant of

Kerr's *Cervus cuguapara*, is applied to specimens from Manaos. The new name *Mazama simplicicornis* var. *kosertzi* occurs on three plates showing a skull from Rio Grande do Sul. A colored plate shows the type specimen of Natterer's *Nanelaphus nambi* from the original in the Vienna museum.)

Osborn, Henry Fairfield. The evolution, phylogeny and classification of the Proboscidea. Amer. Mus. Novit., no. 1, pp. 1–15, 4 figs. January 31, 1921.

Petronievics, Branislav. On the law of irreversible evolution. Ann. Rep. Smithsonian Inst., 1918, pp. 429–440. 1920. (Translated by Gerrit S. Miller, Jr.)

Ravenel, William de C. Report on the progress and condition of the United States National Museum for the year ending June 30, 1920. 1920. (Includes reports by head curators of departments. Half-tone plate of mounted skeleton of *Brontotherium hatcheri* Osborn.)

Royal Zoological and Acclimatisation Society of Victoria. Fifty-sixth annual report and report of the annual meeting of the society for the year 1919. Melbourne, 1920. (List of animals living in the Melbourne zoological park. Five half-tone plates of mammals and a plan of the gardens.)

Shufeldt, R. W. American bears. Amer. Forestry, vol. 27, pp. 22–31, figs. 1–12. January, 1921.

——— Types of mammals. With notes on hybrids, diseases, albinism, and other conditions equally applicable to man. Med. Record, reprints paged 1–23, 5 figs. January 29, 1921.

Skinner, M. P. Story of the Whitebar elk. Nat. Hist., vol. 20, pp. 576–583. December, 1920.

Takenouchi, Matsuziro. Studies on the reputed endocrine function of the thymus gland (albino rat). Journ. Exper. Zool., vol. 29, pp. 311–342. October, 1919.

Thomas, Oldfield. A new tuco-tuco from Bolivia. Ann. and Mag. Nat. Hist., ser. 9, vol. 7, pp. 136, 137. January, 1921. (*Ctenomys goodfellowi*, sp. nov., from Esperanza, Nuflo de Chaves, Bolivia.)

——— Two new Muridæ discovered in Paraguay by the Marquis de Wavrin. Ann. and Mag. Nat. Hist., ser. 9, vol. 7, pp. 177–179. February, 1921. (*Oryzomys wavrini* and *Akodon toba*, new species from the Northern Chaco.)

——— A new mountain vizcacha (*Lagidium*) from N. W. Patagonia. Ann. and Mag. Nat. Hist., ser. 9, vol. 7, pp. 179–181. February, 1921. (Describes *Lagidium boxi* from the upper Rio Negro, Patagonia.)

——— A new monkey and a new squirrel from the Middle Mekong, on the eastern frontier of Siam. Ann. and Mag. Nat. Hist., ser. 9, vol. 7, pp. 181–183. February, 1921. (*Pithecus laotum* and *Dremomys rufigenis laomache* are described as new.)

——— New *Rhipidomys*, *Akodon*, *Ctenomys*, and *Marmosa* from the Sierra Santa Barbara, S. E. Jujuy. Ann. and Mag. Nat. Hist., ser. 9, vol. 7, pp. 183–187. February, 1921. (*Rhipidomys austrinus*, *Akodon sylvanus*, *Ctenomys budini barbarus*, and *Marmosa elegans sponsoria* are new forms from Argentina.)

Thomas, Oldfield, and Herbert C. Robinson. Some new insular squirrels of the *Callosciurus caniceps-concolor* group from peninsular Siam. Ann. and Mag. Nat. Hist., ser. 9, vol. 7. pp. 118–123. January, 1921. (Nine new forms of *Callosciurus*.)

TROUESSART, E.-L. La pluralité des espèces de gorille. Bull. Mus. d'Hist. nat., pp. 102–108, 191–196 (1–13 of reprint), 9 figs. 1920. (Material in the Paris museum shows that two distinct species of gorilla inhabit West Africa; the *Gorilla beringei mikenensis* of Lönnberg, from the lake region, is regarded as representing a third very distinct species.)

——— *L'Echinoprocta rufescens* (Hystricidaé), décrit par Gray en 1865, retrouvé en Colombie, pres de Bogotà. Bull. Mus. d'Hist nat., pp. 448–453, 3 figs. 1920. (Revised diagnoses of genus and species.)

TROUGHTON, ELLIS LE G. Notes on Australian mammals. No. 1. Rec. Australian Mus., vol. 13, no. 3, pp. 118–122, figs. 1–6. December 4, 1920. (*Chalinolobus morio, Eptesicus pumilus, Epimys assimilis.*)

WILLEY, A. A question of bibliography. Science, n. s., vol. 52, pp. 608–609. December 24, 1920. (Asks for information as to what "Mr. Lockhart" is quoted in Coues' Fur-bearing Animals as authority for observation on habits of the wolverine.)

THE NORTHERN CALIFORNIA SECTION OF THE AMERICAN SOCIETY OF MAMMALOGISTS

The Northern California Section of the American Society of Mammalogists was started on January 8, 1920, when, at the suggestion of Dr. Joseph Grinnell, a meeting of persons interested in the study of mammals was held at the California Museum of Vertebrate Zoology in Berkeley. Organization was effected at that meeting and affiliation with the main Society was accomplished the following month. During the year 1920 nine meetings were held, there being a recess over the summer months when a number of the members were absent on field trips. The attendance has varied from five to fifteen but the degree of interest shown is far above that indicated by the attendance. Meetings of other scientific organizations in the San Francisco Bay region have made it impossible for all the local members to be present at each meeting of the section and absence on field trips has further interfered with attendance.

The field of interest has been quite wide although greater emphasis has been laid upon the life histories of mammals than upon any other one subject. The programs of the several meetings were as follows:

January 8, J. Grinnell, On kangaroo rats; J. Dixon, Trapping and trappers in central and southern California.

February 5, A. B. Howell, The California mastiff bat; Some Californian experiences with bat roosts (see this Journal, 1920, pp. 111–117; pp. 169–177).

March 4, Dane Coolidge, Collecting mammals in Italy and France in 1900.

April 1, J. Dixon, The golden beaver at Snelling, California.

May 6, Prof. C. A. Kofoid, Experiences with the wild mammals of southwestern British India.

August 26, Prof. J. S. Kingsley, Some reminiscences of vertebrate zoologists.

September 16, Symposium on the status of deer in the central coast counties of California.

October 28, "Book evening" at the University of California Library.

December 9, Dr. T. T. Waterman, Indian legends relating to western mammals.

One meeting during the year, that on September 16, was held in San Francisco, and one at the University Library, while the remainder were held at the Museum of Vertebrate Zoology. The greater part of the local membership resides in Berkeley and so most of the meetings are held there, but in fairness to those living in San Francisco one or more meetings each year will be held in that city. The first Thursday of each month has been chosen as the regular meeting night and this plan will not be changed except in special circumstances. The organization has been maintained in as simple a manner as possible, the conduct of the meetings is quite informal, and the only levy during the past year was for the printing of meeting notices.

Those in attendance during the past year feel that much good has resulted from the Section and we would strongly urge that members of the Society in other localities combine in like manner and establish their own Sections.

It is the desire of the Section that members of the Society at large from other parts of the country, when in the Bay region, will get in touch with the Section and attend its meetings.—Tracy I. Storer, Secretary, *Museum of Vertebrate Zoology, Berkeley, California.*